**Student Name:** Will Harrison

**Topic/Clinical Question:** What are the biomechanical risk factors for the development of Iliotibial Band Syndrome (ITBS) in Runners?

**Databases Searched:** PubMed, Cochrane

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| **Author/Year** | **Purpose/Design/****Subjects** | **Description** | **Measurements/Outcomes** | **Findings** | **Comments/****Limitations** |
| Louw et al., 2014 | **Purpose:** To identify biomechanical risk factors in the development of ITBS in runners.**Design**: A systematic review of 12 randomized controlled trials**Subjects**: Male and female distance runners with ITBS (most subjects were between the ages of 18-50 years) | The authors explored the potential risk factors for ITBS by independently analyzing the biomechanics of the foot, ankle, knee, and hip. Additional considerations were ITB strain and impingement, strength, ground reaction force, and joint coupling. | **Visualization of dynamic biomechanics:** Camera Motion Capture Systems (6 camera and 8 camera systems), force plates**Strength:** (handheld dynamometry, isokinetic dynamometry) | **Retrospective Analysis:** Runners with ITBS have greater internal tibial rotation during stance, and decreased hip adduction/abduction range of motion. No differences noted between groups at the ankle joint. No muscle strength or endurance differences between groups.**Prospective Analysis:** Individuals who later develop ITBS have greater internal tibial rotation and hip adduction during stance phase; possible increased ITB strain associated with hip adduction in stance. | The authors state that the findings should be interpreted with caution. Subjects in three of the studies ran barefoot, which makes comparison to shod runners more difficult. |
| Van der Worp et al., 2012 | **Purpose:** To review the biomechanical risk factors, diagnosis, and treatment for ITBS in runners.**Design:** A systematic review of 14 RCTs and observational studies that met the methodological criteria. 7 studies were focused on treatment of ITBS, and 9 studies were focused on etiology.**Subjects:** Adult runners aged 18 or older  | This was a comprehensive systematic review designed to explore etiology, diagnosis, and treatment of ITBS. For the purposes of this Evidence Table, only the results that pertain specifically to etiology and biomechanical risk factors will be highlighted. | **Strength:** Isometric, concentric, and eccentric peak torque of the hip abductors and adductors. **Biomechanics:** Kinetic and kinematic differences at the foot, ankle, knee, and hip**Shoe wear/running surface** | **Strength:** One study found no difference between subjects with and without ITBS (20 subjects; 10 with ITBS, 10 control); another study found a significant difference between strength of the injured and uninjured LE in subjects with ITBS (50 subjects; 20 with ITBS, 30 control).**Biomechanics:** Most conclusive results suggest greater hip adduction, tibial internal rotation, and rearfoot inversion moment during stance phase. The stance limb also appears to remain more adducted throughout stance compared to the uninvolved side.**Shoe wear/running surface:** One study found that subjects with ITBS were more likely to wear New Balance shoes and run at low speeds for long distances. (210 subjects in this cohort study; authors reported that 30% of subjects wore New Balance shoes, but provided very little additional details about findings for shoe wear beyond this broad statement). | Only three of the studies were RCTs, and most of the studies had very small sample sizes (seven had fewer than 50 subjects). Seven of the studies included in this review were also included in the systematic review by Louw et al. The findings regarding shoe wear should be considered with skepticism due to relatively little information provided by the authors. |
| Aderem et al., 2015 | **Purpose:** To analyze the biomechanical risk factors of the lower extremity, trunk, and pelvis associated with ITBS in runners.**Design:** A systematic review of 12 cross-sectional and 1 prospective study**Subjects:** Information regarding subject demographics was not specified in the study | The primary goal of this systematic review was to build on prior research by Van der Worp et al., and Louw et al. The authors of this study sought to expand the scope of potential biomechanical risk factors by considering causal influences at the trunk and pelvis in addition to the lower extremity. | **Gait Analysis (3D Motion Analysis):** A variety of different Camera Motion Capture Systems (6, 8, 9, and 15 camera systems) and force plates | Female runners with ITBS wearing shoes have greater internal knee rotation during stance phase. These same subjects also demonstrate greater ipsilateral trunk flexion during stance phase. In prospective analysis, subjects who later developed ITBS had greater internal knee rotation and hip adduction. *Note*: The authors did not define or provide a biomechanical explanation of “internal knee rotation” in this study. | The authors of the study acknowledge the limitations of small effect sizes and relatively few studies to include in the review. However, the review did a nice job of adding to the research by providing additional information regarding trunk flexion during stance in subjects with ITBS.  |
| Mucha et al., 2016 | **Purpose:** To assess the relationship between lower extremity injury and hip abductor weakness in runners.**Design:** Systematic review of 11 cross-sectional and prospective studies that evaluated hip abductor strength in relationship to various lower extremity injuries.**Subjects:** Subjects were defined as “distance runners” but no other demographic information was provided. | This study assessed the relationship between hip abductor strength and several different lower extremity injuries, including ITBS, Achilles tendinopathy, tibial stress fracture, patellofemoral pain syndrome, and medial tibial stress syndrome. Five of the included studies specifically addressed ITBS in runners. | **Hip Abductor Strength:** Handheld Dynamometry, Biodex System 4 Dynamometry, and Isomed 2000 Dynamometry | Of all the lower extremity conditions considered in this study, only ITBS demonstrated a relationship with hip abductor weakness. The authors conclude that hip abductor weakness may be related to the development of ITBS in runners. *Note*: The authors did not report any other patterns of lower extremity weakness and did not provide information regarding hip extension strength. | The effect sizes of the five studies that assessed ITBS ranged from small to large, and all five studies were cross-sectional in design. The authors acknowledge that the findings of this study show correlation but not causation. |
| Noehren et al., 2007 | **Purpose:** To compare pre-existing lower extremity frontal plane and transverse plane kinematics and kinetics between female runners who would later develop ITB Syndrome and those who would not.**Design:** Prospective analysis of female runners who would go on to develop ITB Syndrome.**Subjects:** All subjects were females between the ages of 18-45 who ran at least 20 miles per week and were injury-free at the beginning of the study. 400 subjects included in study; 18 developed ITB syndrome during 2-year period. | This study was unique due to its prospective design with the initial hypothesis that runners who would later develop ITB Syndrome would initially demonstrate greater rearfoot eversion, hip adduction, and knee internal rotation. | **Running kinematics and kinetics:** 3-dimensional imaging with use of retro-reflective markers place on lower extremities and trunk; force plates; 3D software utilized to compile data**Diagnosis:** Any suspected ITB Syndrome injury was required to be diagnosed by a physician, physical therapist, or athletic trainer  | The ITB Syndrome group demonstrated significantly greater peak knee internal rotation (p=0.01) and greater hip adduction at foot strike and throughout stance phase (p=0.01). There were no significant differences between groups for rearfoot eversion, inversion moment, or knee flexion. – There was a small subset (4 subjects) of the ITB Syndrome group that demonstrated excessive rearfoot eversion (these subjects also had the greatest tibial internal rotation). | As hypothesized, runners who later developed ITB syndrome presented with greater knee internal rotation and hip adduction. The authors stated that they were surprised by the findings that showed no significant differences between groups for rearfoot eversion. The authors suggest that the biomechanical etiology of ITB Syndrome is not necessarily uninform. While most subjects appeared to present with proximal risk factors, a small subset demonstrated excessive rearfoot eversion and coupled tibial internal rotation.  |
| Messiers et al., 1995 | **Purpose:** To examine biomechanical, anthropometric, strength, and training variable differences between runners with and without ITB Syndrome.**Design:** Cohort study in which recreational runners were recruited from the local community for assessment**Subjects:** 737 runners initially evaluated over 2.5 years; ultimately 56 subjects with ITB syndrome and 70 control subjects who were symptom-free were included in the study. | This study had a slightly larger scope of analysis than the other studies included in this table. In addition to biomechanical risk factors, the authors also sought to determine anthropometric and running variable risk factors that may contribute to the development of ITB syndrome. | **Training variables:** Types of running surface (asphalt, dirt, track, cross-country); Any cross-training activities (running, cycling, swimming); Footwear usage (number of miles on shoes).**Anthropometrics:** Age, body mass, height, Q-angle, leg-length, knee range of motion, and arch height**Strength:** Isokinetic measurements of the knee flexors and extensors (Cybex II+ isokinetic dynamometer)**Rearfoot movement:** High-speed videography conducted while subjects ran on a treadmill.**Kinetics:** Running on a force platform. | The authors found several factors that were associated with greater incidence of ITBS (p<.10): weekly mileage, running on a track, running pace, swimming for cross-training, and duration of current running protocol. Injured runners also tended to be shorter than runners in the control group. Injured runners demonstrated significantly less knee flexion and extension strength than the control group, had greater supination velocity, and had decreased maximum braking forces during running. A composite analysis revealed that the most important factors were increased mileage and increased braking forces (p<.05) | This study looked at a number of different potential contributors to ITBS, and ultimately provided a somewhat murky perspective due to numerous findings. For instance, the findings of decreased strength make sense, but decreased braking forces seems counterintuitive to the mechanism of injury. The study may have benefited from a larger sample size or from a p-value set at 0.05 in order to arrive at more definitive conclusions.  |

**References**:

1. Louw M, Deary C. The biomechanical variables involved in the aetiology of iliotibial band syndrome in distance runners - A systematic review of the literature. *Phys Ther Sport*. 2014;15(1):64-75. doi:10.1016/j.ptsp.2013.07.002.
2. Van der Worp MP, Nijhuis-Van der Sanden MWG, Backx FJ, de Wijer A. Iliotibial band syndrome in runners: a systematic review. *Sport Med*. 2012;42(11):969-992.
3. Aderem J, Louw QA. Biomechanical risk factors associated with iliotibial band syndrome in runners: a systematic review. *BMC Musculoskelet Disord*. 2015;16:1-16. doi:10.1186/s12891-015-0808-7.
4. Mucha MD, Caldwell W, Schlueter EL, Walters C, Hassen A. Hip abductor strength and lower extremity running related injury in distance runners: A systematic review. *J Sci Med Sport*. 2016;(2016):1-7. doi:10.1016/j.jsams.2016.09.002.
5. Noehren B, Davis I, Hamill J. ASB Clinical Biomechanics Award Winner 2006. Prospective study of the biomechanical factors associated with iliotibial band syndrome. *Clin Biomech*. 2007;22(9):951-956. doi:10.1016/j.clinbiomech.2007.07.001.
6. Messiers SP, Edwards DG, Martin DF, Lowery RB. Etiology of iliotibial band friction syndrome in runners. *Med Sci Sports Exerc*. 1995;27(7):951-960.