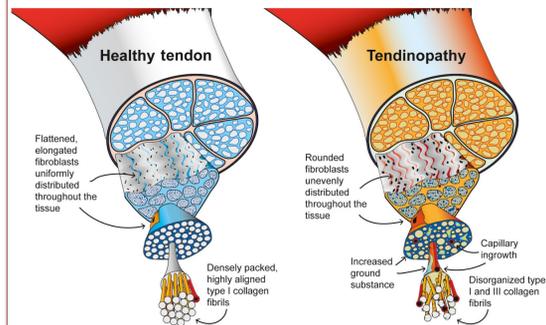


Introduction

- 33 million musculoskeletal injuries annually in the US, 50% involve tendon and ligament



- Patellar tendinopathy (PT)** is a degenerative condition
- Characteristics: load-dependent anterior knee pain; affected collagen network, healing qualities, and vascularization of tendon
- PT also known as “jumper’s knee”

- Multiple studies show highest PT incidence in volleyball players: injury rates at 44.6% for elite players, 14.4% for non-elite players, and highest amongst women’s volleyball in US collegiate athletics

- PT brought on and exacerbated by overuse
- Critical extrinsic factor:** mechanical loading on patellar tendon during activity
- Injury to patellar tendon can persist and cause debilitating pain, leading to over half a year of absence or premature retirement from athletics
- More research on injury prevention is needed, especially given increasing participation in high school athletics

- Specialized footwear for volleyball, 3 popular brands: ASICS, Mizuno, and Nike
- ASICS: ASICS GEL technology at rearfoot and forefoot of shoe, has layer of foam
- Mizuno: Wave technology with Pebax (copolymer consisting of polyamide and polyester blocks)
- Nike: Nike React foam
- Gap in knowledge:** how different designs from these top brands impact ground reaction forces and PT risk during volleyball activities—little independent testing done

Objective

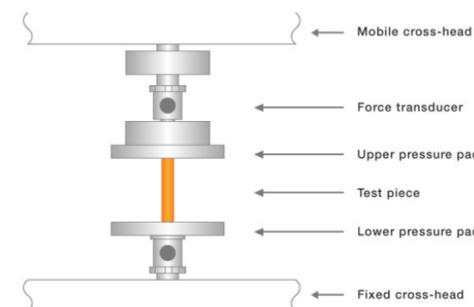
- To compare the performance of popular volleyball shoe brands in decreasing mechanical loading on the knee and minimizing PT risk in both a defined, controlled environment and a clinical setting

Hypothesis

- Central hypothesis:** volleyball footwear will help relieve tendon strain due to the cushioning in the midsole, which will help absorb shock upon landing impact and spread out the ground reaction force (GRF) over time
- Experimental groups will have lower GRF, tendon strain, and injury rates
- ASICS group will have the lowest GRF, tendon strain, and injury rate

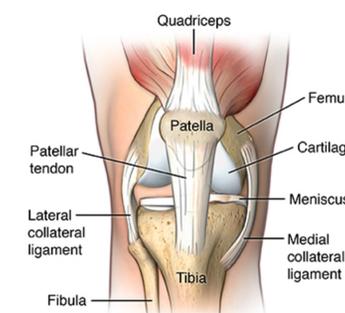
Methodology

- AIM 1:** test the effect of volleyball shoes on reducing tendon strain



- Compressive test using core of foam from 3 brands to measure CSA and get modulus and failure properties
- Compressive load test with apparatus to mimic velocity of movement

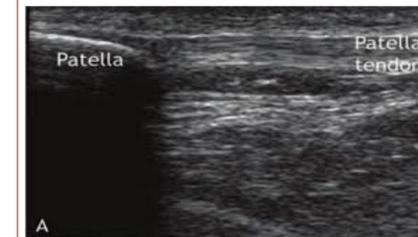
- Treatment groups: 1 control; 3 experimental—nonspecialized; ASICS, Mizuno, Nike
- Subject groups: subjects in late teens with 2+ seasons worth of experience in an offensive position
- Activities: approach (the runup and jump sequence for spiking), which will be normalized to a 3-step approach for all positions at their typical starting points for high sets, and blocking, at the net (no transition or lateral movement) and swing blocking (block after sideways approach)
- Have subjects perform set of standardized jump sequences on force plates to measure GRF



- Image subjects during activity using real-time MRI and calculate tendon strain as a measurement of distance between patella and tibia over time

Methodology Cont.

- AIM 2:** examine if the experimental group has a change in injury rate throughout high school
- Subject groups: subjects to play only volleyball (an offensive position) in the 4 years



- Ultrasound (US) at preseason, in the middle of the season, and postseason each year
- US imaging for tendon abnormalities: increased tendon thickness, neovascularization
- Physical examinations at preseason, in the middle of the season, and postseason each year
- Observe if there is pain or stiffness at the patellar tendon
- Question subjects on intensity, duration, and causes of pain

Discussion

- Critical need** for research on injury prevention for at-risk athletes, not only for their athletic career but also for their quality of daily life
- Elucidation of external factors that can ameliorate PT can further be extrapolated to present a ubiquitous method of decreasing patellar tendon injury risk
- Although measures were taken to decrease external factors in the experiments, PT risk can’t be solely a function of mechanical loading intensity, or lack thereof
- Process of aim 1 testing is theoretical, difficult to say if real-time MRI can accurately image subjects moving at natural velocity when performing standardized set of activities
- Aim 2 measures injury rate in a two-fold process in hopes of limiting subjectivity with regards to pain sensitivity and degree of injury
- However, it can’t account for external factors that may affect injury risk, such as innate qualities or accidents

References

Please visit [here](#) to see a list of references