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Impact Forces on Five Common Running Surfaces

Thomas Urrunaga

Brian Falk

Mark Gatti

Kurt M. DeGoede

Peak Impact Forces

ON FIVE COMMON RUNNING SURFACES

Thomas Urrunaga, Brian Falk, Mark Gatti, and Kurt M DeGoede

ETOWN
ELIZABETHTOWN COLLEGE

Why?

It is commonly believed among runners of all skill levels that the surface one runs on, impacts the risk of injury because of the peak force is greater because one surface is "harder" than the other [1 2]. While surface hardness does vary, this study will determine if the footwear of the athlete is enough protection to mitigate these differences.

We hypothesize the measured peak force during a simulated shod heel strike will not be significantly different across several common synthetic running surfaces but may be different across alternate shoes.

How?

A force impactor was constructed to measure the vertical forces of a heel strike while running. A load cell was attached to the end of a two-foot arm. A release cable was attached to a cross bar to the end of the arm that was connected to a trigger release (Figures 3-5). Impactor was resighted and the shoe was remounted for each drop.

15 drops were done for each surface/shoe combination falling at 2 m/s, simulating a heel strike during running [3].

To compare across surfaces asphalt, rail trail (crushed cinder), outdoor Mondo®, and concrete data were taken from one pair of shoes where the less variability and therefore most accurate measurements were taken. (15 measurements for each surface).

Examining 3 typical cushioned training shoes from competitive NCAA track athletes, we combined the data across all surfaces for each shoe (75 measurements for each shoe). RM-ANOVA and *post hoc* t-test were used to compare conditions.

What?

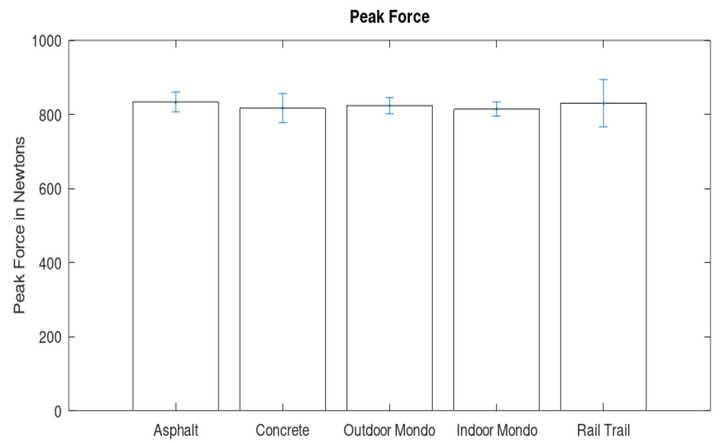

Figure 1: Impact force.

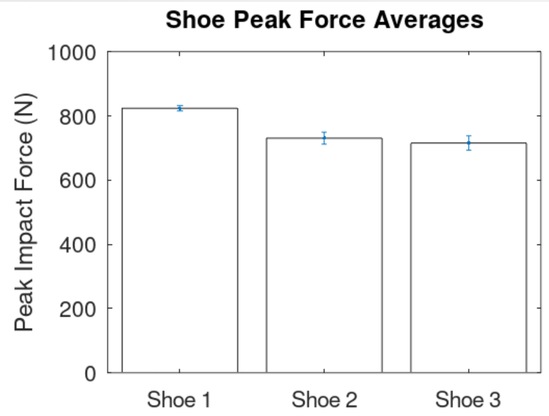

Figure 2: Peak Forces per Shoe.

Figure 3:
End of arm.

Figure 5:
Set up.

Figure 4: View from tower.

So What?

We have expanded on previous data, collected in shoe during running [4]. With this method of data collection, this study did not have to be concerned with the changes of the human body that occur stride to stride.

We also measured no statistical difference: all $p>0.05$. There were no differences on the same shoes on the same surfaces. All peak force averages are very close to one another regardless of surface.

Analysis indicates that Shoe 1 exhibited a higher impact force ($p<0.01$), and no difference in impact force across surfaces ($p>0.05$). However, we attribute the small inter-surface differences observed in the rail trail and concrete, as seen in the wider error bars on these surfaces, to variability in the sighting of these surfaces and mounting the shoes.

When running in cushioned shoes, ground surface plays little role in determining impact forces. Runners concerned with impact force should focus on shoe choice not running surface. The location for safe training runs should be decided based on factors other than surface material for surfaces ranging from Mondo to concrete.

References

[1]Bloom, Marc https://www.runnersworld.com/uk/health/injury/a760152/top-10-running-surfaces/ [Accessed 8 11 2022].

[2]Wingenfeld, Sascha https://www.runtastic.com/blog/en/best-surface-running-training/ [Accessed 8 11 2022].

[3]B. Nigg "The Influence of Running Velocity and Midsole Hardness on External Impact Forces in Heel-Toe Running." [Accessed 8 9 2022]

[4]DeGoede, et al. ASB 2021.

urrunagat@etown.edu