

Behind the Design

What Lies Behind a Soccer Cleats' Design

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Introduction

Question:

How does the design of a soccer cleat affect performance?

Problem:

Many soccer players are choosing the wrong cleat design for performance.

Hypothesis:

If the shell material, Padding, cleat formation, grip, and support of a soccer cleat is enhanced and tested, then time in an obstacle course will be quicker.

Research Paper

How the Design of Soccer Cleats Affects Performance

Playing soccer with the incorrect designed cleats is very risky and can lead to injury (Evans). Normal soccer cleats are not suitable for hard, artificial, or indoor surfaces (Bauer). Using incorrectly designed cleats in terms of gender, terrain, fit, body mass, and materials can even give players an injury strong enough to keep them on the bench (Bauer). The cleat design also has serious effect on control, accuracy, and speed. Using the wrong type of design can be fatal to a player's career, so it is vital to find a cleat with the perfect balance from all point of views.

In order to thoroughly understand this experiment, there are three terms in which need to be defined; soccer shoe design, soccer shoe material, and performance in obstacle course. The “soccer shoe design” is made up of the following concepts; laces, padding, support, stitching, and cleats. The laces on the cleat are always on the top of the shoe, however they curve in a specific way to help enhance ball spin while shooting (Joan). Padding in the cleats is inserted to fit the width, length, and arch of the foot (Joan). Support is given throughout the shoe, such as extra padding, more sturdy materials, and higher cuts, to help with any disabilities of a player. Stitching design on the cleats is usually divided up where the different materials meet. The cleats are the most important part of the shoe; and have many different shapes and designs for different terrains (Newell). They are only made of soft materials and must be not less than $\frac{3}{8}$ inch in diameter and $\frac{3}{4}$ inch long from the shoe (Midgley). The “Soccer Shoe Material” is made up of the concepts of leather, synthetic, thread, and plastic. Leather is one of the more common soccer shoe materials, and kangaroo leather is the most popular type (“Soccer Shoes”). Synthetic material, the most common being KNG 100, is the most common material used in the game, because it doesn’t stretch and is more water proof (Joan). Thread on the soccer shoe is sturdy and thick to keep the shoes from falling apart (“Soccer Shoes”). Plastic is used in the cleats of the shoe, as it is softer and will prevent injuries to players (Midgley). Lastly, the “Performance in an obstacle course” is made up of the concepts of dribbling, shooting, passing, grip, and speed. Dribbling in the obstacle course shows the control the cleats have on the ball while maneuvering. Shooting shows accuracy of the cleats strike on the ball. Passing shows how the shape of the cleats affects accurate passing. Speed shows how the cleats slow or speed a player up while in action.

One experiment recently founded by the Cincinnati Children's Hospital Research Foundation discovered the different foot loading patterns from the different design of soccer shoes (Midgley). The experiment consisted of two identical courses, each attempted by 17 college athletes (Midgley). The athletes each wore a new soccer specific molded cleat, containing a flexible in-shoe pressure distribution measuring insole in the right cleat to measure foot loading patterns (Midgley). Each athlete was then timed as they ran each course twice with the "Brower Timing Systems"(Midgley). After running the experiment, the foot loading patterns came back showing which cleats gave higher pressure while performing the course (Midgley). The results showed significant difference with peak pressure and foot loading patterns in central forefoot, medial forefoot, and lateral midfoot during the course (Midgley). The time taken to perform each movement in the course would take longer when the pressure is high and the foot loading pattern different (Midgley). This experiment concluded that the design for the soccer shoes has effect on pressure and foot loading pattern through the foot, making the time it takes to perform an obstacle course longer.

The design of the soccer cleats affect all players who want to get ahead of the game. The more evolved cleat will bring greater innovation, comfort, and performance to players, giving them a competitive advantage as well as keeping them safer on the field (Newell). If players still used the old, large, clumsily designed soccer shoes, the quick agile sport wouldn't be possible ("Soccer Shoes"). The designs on soccer shoes can help prevent knee injuries, and can help prevent knee injuries caused by cleats sticking to the ground (Newell). The different designs of the cleats will also help with more minor injuries and irritations (Newell). For example; liners and materials selected in the cleat design can wick out moisture and prevent

rubbing, and lead to a better balance of comfort, flexibility, and traction for the players (Newell). Different cleat designs can be molded for different body build and positions, and wearing a shoe with the wrong arch levels and foot widths and lengths can be extremely irritating to the foot, making performance in them uncomfortable and slowing you down (Newell). Lastly, old shoe designs prove to decrease a player's performance ("Soccer Shoes"). These old designs did not allow for sharp turns or passing, and restricted any movement while playing ("Soccer Shoes"). Research on cleats with top quality lightest materials, to make it easier to run in the shoe, will allow the shoe to last for longer ("Soccer Shoes"). All around, the study of the design of cleats is extremely important, as it can either lead to injuries that will put players on the bench, or quicker step, and better grip, letting players dominate on the field (Newell).

During the experiment, "Soccer Shoe Design", "Soccer Shoe Materials", and "Performance in Obstacle Course" will be put to the test in a 5-staged obstacle course. To begin, research on the term "Soccer Shoe Design" will be used to select 5 differently designed cleats; one selected each from laces, padding, support, stitching, and cleats. Using 5 members from the Deep Run Charge Soccer Team, an obstacle course will be performed twice by each athlete. The five stages of the obstacle course will be dribbling, shooting, passing, grip, and speed. The stages dribbling, grip, and speed will each be measured using stop watches, shooting and passing by accuracy of striking target. The results of the obstacle course will then be graphed in a data table, and using the term "Soccer Shoe Material", sort how each material had done in the course. After all testing has been drawn to a close; a conclusion of the best soccer cleat design for performance will be created.

Method and Materials

Materials:

1 Stopwatch (School)

3 Humans, Homo Sapiens (Deep Run Charge)

1 Shell Design Enhanced Soccer Cleats (worldsoccershop.com)

Lotto Zhero Gravity Ultra FG

1 Pair Cleat Formation Enhanced Soccer Cleats (worldsoccershop.com)

F50 adizero TRX FG

1 Pair Padding Enhanced Soccer Cleats (Sports Authority)

T90 Shoot IV FG

1 Pair Support Enhanced Soccer Cleats (worldsoccershop.com)

Pele 1970 FG MS

1Pair Grip Enhanced Soccer Cleats (Sports Authority)

Adidas Predator Absolado LZ TRX FG

1 Pair Basic Running Shoes (Home)

Adidas Women's Indoor Soccer Shoe

30 Orange Training Cones (DRVSA)

1 Can of Orange Spray Paint (Home)

6 Size 5 Soccer Balls (Home)

Variables

Independent Variable: The Design of the Soccer Cleat

Dependent Variable: Speed (Seconds)

Control Group: Running the Obstacle Course Five Times per Volunteer with Basic Running Shoes

Controlled Variables: Obstacle Course, Weather, Time of Day, Type of Surface

Experimental Procedure:

1. Create the obstacle course
 - a. Using one bottle of orange spray paint, mark a starting point
 - b. Using spray paint, draw a 20 meter line, this is the speed without ball portion
 - c. Using spray paint, draw a perpendicular line at the end of the 20 meter line, indicating end of speed without ball portion
 - d. Place a size 5 soccer ball at the perpendicular line

- e. About 3 meters out from end of speed without ball portion, place 5 cones in a straight line each 20 centimeters apart. Repeat this 3 meters away to get 5 sets of three cones, this is the speed with ball portion
 - f. Mark a 20 meter circle with orange spray paint, indicating the area in which the volunteer will do moves with a ball in
 - g. Mark a perpendicular line after the 20 meter circle, indicating the end of the speed with ball portion and end of course
2. Have each volunteer run the obstacle course using basic running shoes (Control test)
- a. Speed without a ball portion
 - i. Volunteer must sprint as fast as they can down the 20 meter orange line until they reach perpendicular line
 - b. Speed with a ball portion
 - i. At the perpendicular line, the volunteer must pick up the ball and begin dribbling through cones
 - 1. Set one: inside of feet only
 - 2. Set two: outside of feet only
 - 3. Set three: right foot only
 - 4. Set four: left foot only
 - 5. Set five: any combination
 - ii. At the end of cones in the 20 meter circle, volunteer must do a combination of any five moves and step over perpendicular line to stop time of course

3. Time speed without a ball portion
4. Time speed with a ball portion
5. Have each volunteer repeat this test 5 times with basic running shoes
6. Repeat steps 2-5 with material enhanced cleats
7. Repeat steps 2-5 with cleat formation enhanced cleats
8. Repeat steps 2-5 with padding enhanced cleats
9. Repeat steps 2-5 with support enhanced cleats
10. Repeat steps 2-5 with grip enhanced cleats

Results

Graphs:

Table #1

Control Test- How basic running shoes affect performance in an obstacle course (Seconds)

Basic Running Shoes	Volunteer 1	Volunteer 2	Volunteer 3
Trial 1	44.1	43.2	43.1
Trial 2	42.4	45.8	43.3
Trial 3	42.8	44.5	42.9
Trial 4	43.3	45.8	44.0
Trial 5	45.6	44.1	43.9
Average	43.6	44.7	43.4

Table #2

Padding- How padding enhanced soccer cleats affect performance in an obstacle course

(Seconds)

Padding	Volunteer 1	Volunteer 2	Volunteer 3
Trial 1	39.1	38.6	37.6
Trial 2	33.8	36.8	38.9
Trial 3	32.5	35.0	36.0
Trial 4	32.1	36.7	35.2
Trial 5	34.0	34.7	34.1
Average	34.3	36.4	36.4

Table #3

Cleat Formation- How cleat formation enhanced soccer cleats affect performance in an obstacle course (Seconds)

Cleat Formation	Volunteer 1	Volunteer 2	Volunteer 3
Trial 1	38.5	39.5	36.3
Trial 2	39.7	41.8	34.9
Trial 3	39.4	42.2	37.0
Trial 4	38.5	37.5	35.0
Trial 5	36.0	34.8	36.9
Average	38.4	39.2	36.0

Table #4

Shell Design- How shell design enhanced soccer cleats affect performance in an obstacle course

(Seconds)

Shell Design	Volunteer 1	Volunteer 2	Volunteer 3
Trial 1	39.0	32.9	46.1
Trial 2	35.3	33.7	38.6
Trial 3	33.8	31.9	39.4
Trial 4	33.5	34.2	36.2
Trial 5	33.6	35.6	38.0

Average	35.0	33.7	39.5
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Table #5

Grip- How grip enhanced soccer cleats affect performance in an obstacle course (Seconds)

Grip	Volunteer 1	Volunteer 2	Volunteer 3
Trial 1	35.1	35.5	39.1
Trial 2	34.3	33.8	35.6
Trial 3	33.2	38.7	34.2
Trial 4	29.2	39.3	34.0
Trial 5	35.0	39.4	33.9
Average	33.4	37.3	35.4

Table #6

Support- How support enhanced soccer cleats affect performance in an obstacle course
(Seconds)

Support	Volunteer 1	Volunteer 2	Volunteer 3
Trial 1	39.1	40.3	43.2
Trial 2	33.9	37.0	37.1
Trial 3	35.2	37.4	35.4
Trial 4	31.5	40.6	36.7
Trial 5	31.6	41.8	37.2
Average	34.3	39.4	37.9

Table #7

How the design of a soccer cleat affects performance in an obstacle course over three
volunteers (Seconds)

Design of Soccer Cleats	Volunteer 1	Volunteer 2	Volunteer 3
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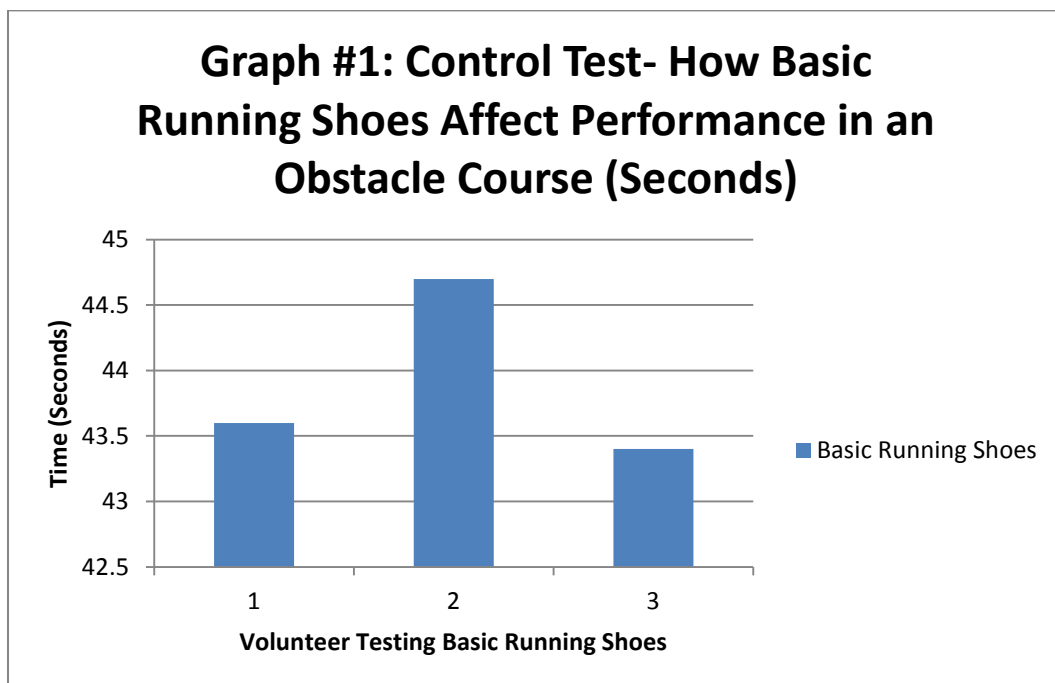
Basic Running Shoes	43.6	44.7	43.4
Padding	34.3	36.4	36.4
Cleat Formation	38.4	39.2	36.0
Shell Design	35.0	33.7	39.5
Grip	33.4	37.3	35.4
Support	34.3	39.4	37.9

Table #8

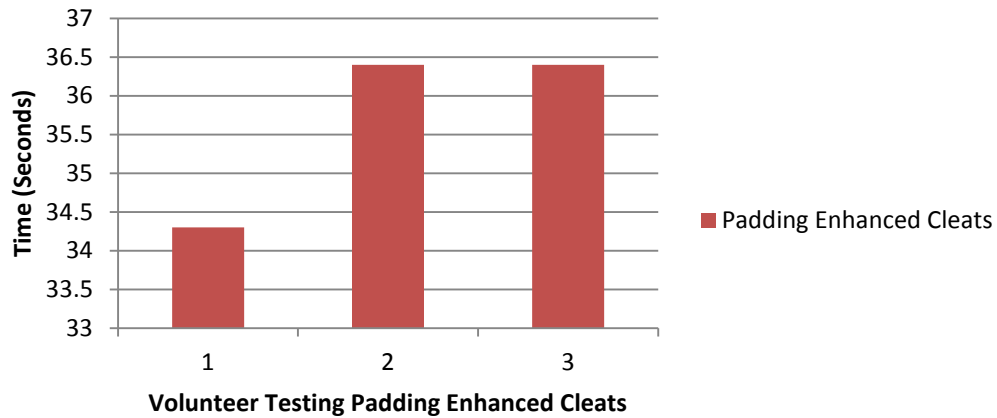
How the design of a soccer cleat affects performance in an obstacle course average (Seconds)

Design of Soccer Cleats	Basic Running Shoes	Padding	Cleat Formation	Shell Design	Grip	Support
Average	43.9	35.7	37.9	36.1	35.4	37.2

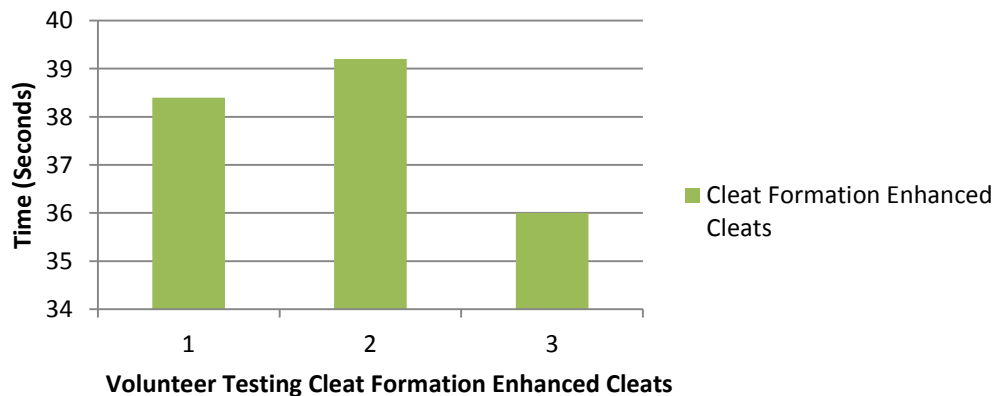
Graphs:



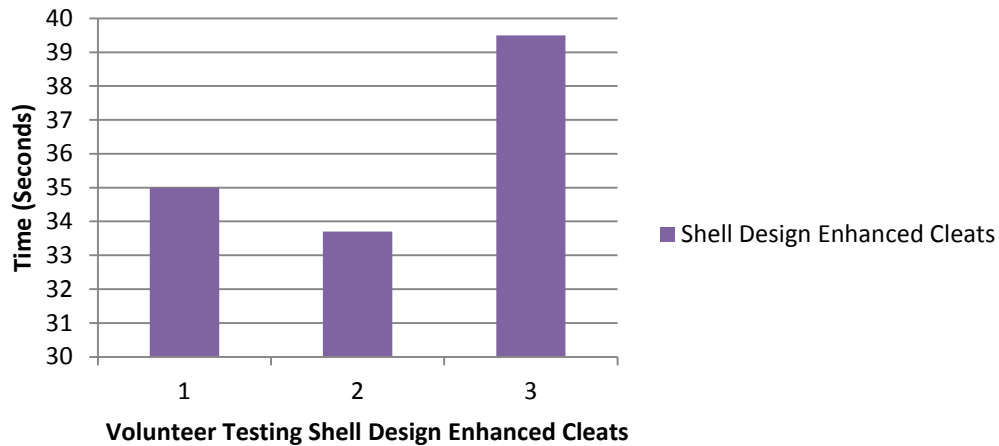
Graph #2: Padding- How Padding Enhanced Cleats Affect Performance in an Obstacle Course(Seconds)



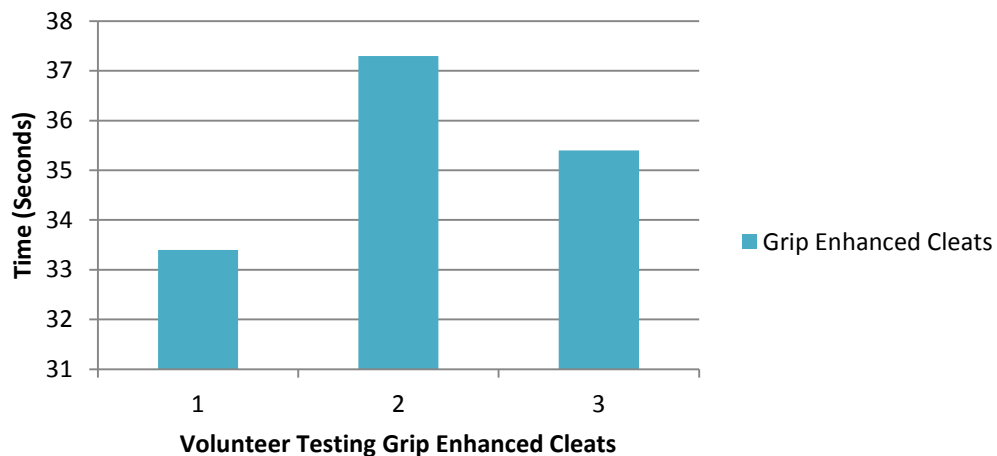
Graph #3: Cleat Formation- How Cleat Formation Enhanced Cleats Affect Performance in an Obstacle Course(Seconds)



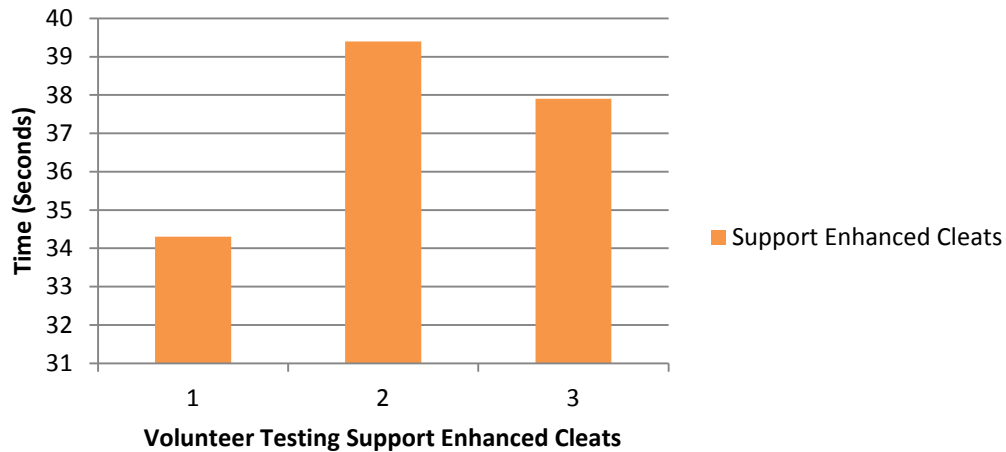
Graph #4: Shell Design- How Shell Design Enhanced Cleats Affect Performance in an Obstacle Course (Seconds)



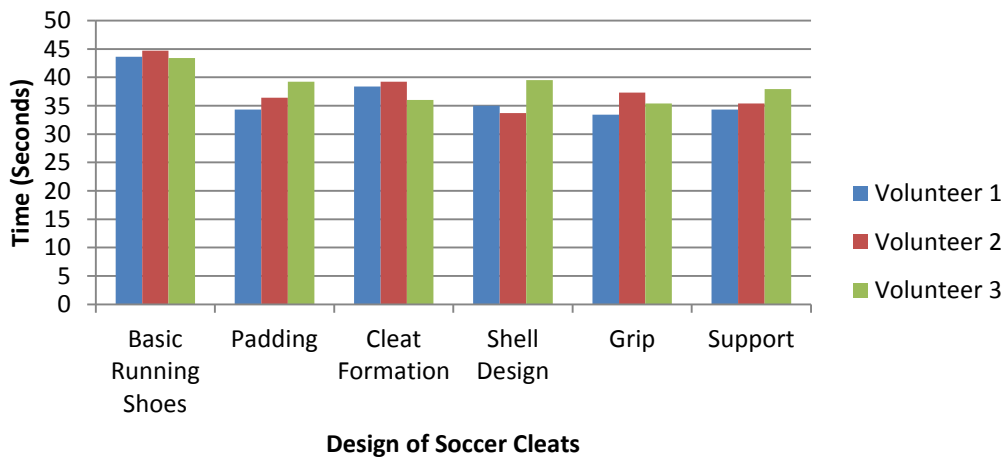
Graph #5: Grip- How Grip Enhanced Cleats Affect Performance in an Obstacle Course (Seconds)

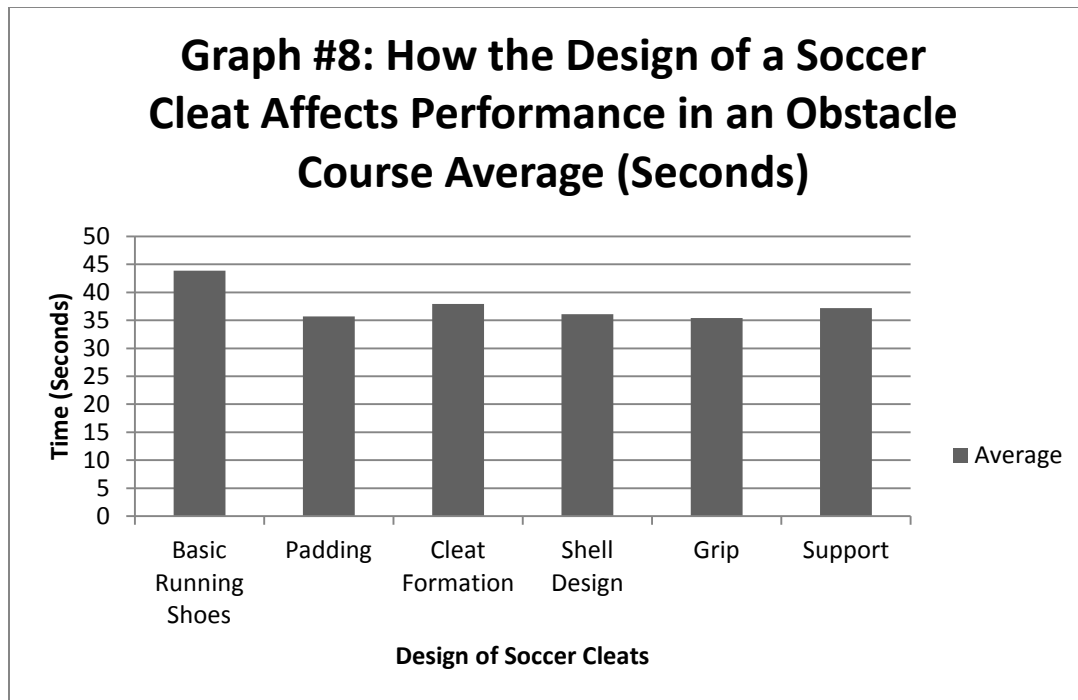


Graph #6: Support- How Support Enhanced Cleats Affect Performance in an Obstacle Course (Seconds)



Graph #7: How the Design of a Soccer Cleat Affects Performance in an Obstacle Course over Three Volunteers (Seconds)





Discussion of Results

In conclusion, enhanced soccer cleat design does affect performance. After testing five different pairs of design enhanced cleats; support, shell, grip, support, and cleat formation, we find that the more enhanced and specially made the grip design of a soccer cleat is, the quicker the performance will be in an obstacle course. Out of all 6 cleats, the worst were the basic running shoes, which had no cleats, support, padding, or grip, and the best cleats were the grip enhanced cleats, which had amazing grip patterns in 5 different areas of the cleats. In order from best cleats to worst cleats, based on average time for all volunteers in seconds, are the grip enhanced cleats, the padding enhanced cleats, the shell design enhanced cleats, the support enhanced cleats, the cleat formation enhanced cleats, and the basic running shoes. People who can find these results useful are those who want that extra edge to put them on

top of their game. During game time, that extra split second can be the difference between win and loss, and it's critical to always be on top of the game. The design of a soccer cleat does affect player's performance. Using cleats that are proven in the experiment to be harmful to a player's performance should not be used, and now soccer enthusiasts know that the best cleat to look for to have the best step on the field are grip enhanced cleats.

In summary, the experiment was held to answer the question: how does the design of the soccer cleat affect performance in an obstacle course. To find which cleat design was the best, and to compare results of each cleat design, 5 pairs of soccer cleats: the grip enhanced cleats, the padding enhanced cleats, the shell design enhanced cleats, the support enhanced cleats, the cleat formation enhanced cleats, and once pair of basic running shoes, were tested in an obstacle course which included speed with and without a ball. Three volunteers, all from Deep Run Charge soccer team tested each pair of cleats 5 times and time was recorded in seconds. The experiment contained human error, which involved stumbling or tripping while performing in the course. The experiment could've been improved if there were more volunteers and more pairs of cleats to test, and if it was held in the summer/spring, not winter. Also, the cleats could've been put to the test more if there was a more elaborate obstacle course.

The experiment did prove the original hypothesis. The hypothesis was: If the shell material padding, cleat formation, grip, and support of a soccer cleat is enhanced and tested, then time in an obstacle course will be quicker. The data showed that even the least improved enhanced cleat was +6 seconds quicker than the basic running shoe, and the quickest cleat was +8.5 seconds faster than the basic running shoe. Each cleat design had improved the

performance in each volunteer, and it became faster as the cleat became more enhanced. For example, the quickest cleat; the grip enhanced cleats with an average speed of 35.4 seconds; were also the most modified- or enhanced- cleats of the group. As the cleats became less enhanced, such as the support enhanced cleats with 37.2 seconds, cleat formation enhanced cleats with 37.9 seconds, and basic running shoes with 43.9 seconds, it took longer for the participant to run the course. In conclusion, the general trend shown was the more enhanced the design of the soccer cleat, the better the performance was. This trend is a mirror image of the hypothesis, and draws the same conclusion: when the design of a soccer cleat is enhanced, then the time in an obstacle course is quicker.

The reason why the design enhanced cleats performed better in an obstacle course than the non- design enhanced cleats is because of each cleats special design. For example; the basic running shoes did so poorly in the obstacle course, with an average of 43.9 seconds, because it does not have the proper design; these shoes did not have cleats, which are essential for working in long grass, and also for ball handling. They also had no padding or support, which made it hard for the volunteers to run easily and work with the ball. Finally, these cleats had no special shell material, and absolutely no grip, which made it near 'impossible' for the volunteers to get a good grip on the ball and have good control when running the obstacle course. Time added up as each of these faults took its toll when the players went. Moving up the results from worst to best, the cleat formation enhanced soccer cleats came in second to last with an average speed of 35.7 seconds. Due to the newer and more enhanced cleats, set in a new formation, the volunteers were able to cut through the grass with ease, improving their time by several seconds. However, this cleat still did poorly because it lacked grip and support, making

it still difficult to fully control the ball, and letting the volunteers move freely. In 4th place, are the support enhanced cleats with an average of 37.2 seconds. This cleat averaged higher than the past two cleats because they had amazing support in the ankle, arch, heel, and forefoot. This led to great stability which allowed each volunteer to have a stable control on the ball. Once again, we see that this cleat still is slower than many others, due to the lack of grip on the cleats, which again doesn't allow for a better grip on the ball. In third place, the shell design cleats with an average of 36.1 seconds. These cleats did so well because they have a completely smooth surface, with no laces, allowing for full accessibility of the foot. However, because there are no laces on these cleats, the cleats were very stiff, and the volunteers were unable to have good flexibility in them while performing. In second place are the padding enhanced cleats with an average of 35.7 seconds. These cleats did very well compared to other cleats because the proper padding removed pressure from all areas of the foot, and also had decent grip on the outside, allowing for comfort while performing as well as moderate grip on the ball. This cleat came just 0.3 seconds shy of first place because it did not have specific grip like the first place cleats do. Finally, we have the best cleats, the grip enhanced cleats with an average of 35.4 seconds. These cleats did the best out of all the cleats because they have amazing grip. These cleats have 5 specific lethal zones located in different areas of the cleat that provide superior grip while performing. Each grip is specially designed for position, it isn't just normal grip. Over all, the specialized grip is definitely what put these cleats on top.

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