Just4Kicks Boston, LLC

The Unicleat ™ Was Inspired By "The Kitten Spike" In The Threaded Socket Of Professional Track Shoe. John Fall

One Shoe Can Change Your Life: Does Footwear Influence ACL Injury?

Posted by JULIE HUBBARD, PT, DPT, MS, CSCS *on* 19 SEP 201921 SEP 2019

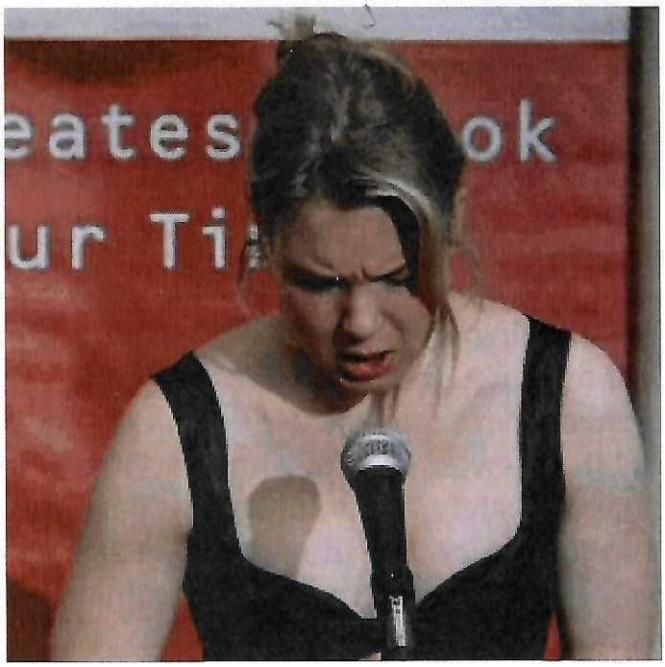
Have you ever fallen out of your gym routine? You started by just taking the day off. You had a long day at work - that's fair. But that day turned into two, and those two turned into three... You get the gist. Now you're five years removed from the gym, and it just seems harder and harder to lace up your shoes and hop on that treadmill.

That's exactly how I feel right now, sitting at my kitchen island, drinking my morning coffee, staring at this blank screen. While I've certainly fallen out of my gym routine (*cough* I'll go tomorrow), I've also fallen out of my blog routine. It's been a couple of months since my last post, so I apologize to everyone following along. In my months of silence, I've taken a new job. I've moved to a new town. I've got a new apartment. I've made some new friends. I've lost some old friends. I've dated a little bit. I've worked a lot a bit. And I've just gotten a new dog. There's been quite a bit of change in my life lately, and while I have been trying to embrace that, I have fallen off the writing wagon, so to speak- something that I actually really enjoy doing. Luckily, -..with the summer coming to an end, I can catch my breath, drink my PSLs in peace, and resume ---writing on a (much) more regular basis.

So - without further ado - let's get into a question I get asked weekly by patients, athletes, and coaches alike. *What soccer cleats should [I, my daughter, my players] get?*

Well, the fashionista in me wants to say the brightest, most obnoxious pair of NIKE Mercurial Vapors you can find (yes, I was that person, and I have already paid for it!). Still, the clinician In me wants to direct you to a fascinating article sent to me by one of my GPS affiliates last month. (Thanks, Craig).

Thomson et al. (2019) investigated the differences between six popular soccer cleats on natural grass throughout one soccer season. These researchers aimed to assess the differences in traction (how well the shoe gripped the ground) between each shoe model and disagreements attributed to the type of grass and climate variables. What they found was interesting, and at the risk of over-simplifying a complex topic, I will summarize the findings below.



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The article started by stating that soccer (or /Jassociation football") is the sport with the highest cutting movements - with players completing upwards of 800 cuts per game. We all know that a player's ability to cut quickly and efficiently largely depends on the grip of their foot or shoe on the ground. What may be less well-known is that there are two different.
'--"types of traction come into play here: translational and rotational traction.

Translational traction is essentially *good traction.* We want to maximize this variable, as it is the horizontal force required to overcome the resistance between the studs and the ground... Basically, this means that the higher the translation traction, the less straight line or side-to-side motion is allowed between your shoe and the ground. This has been linked to improved acceleration, agility, and overall performance.

Rotational traction, on the other hand, is essentially goof with the unicleat™ *bad traction*. We want to minimize this variable, as it is the rotational force required to release the studs through the playing surface in a rotational manner. Basically, this means that the higher the rotational traction, the more force or load must be generated by our bodies to get our foot to rotate on the ground, something we need to do when cutting or pivoting. The higher the rotational traction, the higher the rotational load through our joints, and the higher the risk of lower extremity injury like ACL tear or high ankle/syndesmotic sprain.

This means that we want to find a combination of high translational and low rotational traction without compromising performance on the field. Since stud/cleat configuration and playing surface (species of natural grass, artificial turf) also affect muscle recruitment patterns
1st movement strategies, we must think long and hard before choosing which boot to lace up for the big game. Hope: the hall line of sports and casual swift runnershoes all contain the unicleat™ threaded socket.
Thomson et al. examined the six NIKE shoes illustrated below with one artificial grass (AG.) Model, four firm ground (FG) models, and one soft ground (SG) model. Four of these six models are the most used soccer cleats in the world, according to 2018-19 market reports.

JEH note: Perimeter cleats cause knee and ankle injuries when a person wearing them plants and turns the foot or feet. Jeh Note Law.

After testing these cleats on one Qatar field throughout the soccer season, they found that the shoe model had no main effect on translational traction. What they did find, however, is that the soft ground (screw-in metal-studded) cleat had the highest rotational traction across all months. In contrast, the artificial grass cleat had the lowest rotational traction across all months.

These researchers also found that grass type significantly affected rotational traction. Different species of grass have different mechanical properties and traction levels. They, therefore, also have different lower extremity injury risk levels associated with them. If you have ever played a soccer game down south, you know that the grass is much different than that found in New England. This is because grass is affected by temperature, humidity, and soil moisture. Grass growing in Florida, for example, must survive and adapt to climate demands that are much different from those found in Massachusetts. Much research has shown that heat and drought-resistance warm-season grass (i.e., Paspalum or Bermuda) has much higher rotational traction than cold-season (i.e., Rye) grass. Because of this, the rate of ACL injury on warm-season grass is much higher than that on cold-season grass.

We can't necessarily change the venue or field we have to play on, and we certainly can't change the weather. So - when thinking about modifiable factors - all we have immediate control over is shoe type. *So which cleat type is the best?*

Unfortunately, there is no "one-size-fits-all" kind of answer. Sure, if you are playing on warm-season grass on a sunny day in Texas, you probably don't want to wear soft-grounds. You certainly won't slip, as your translational and rotational tractions will be off the charts. Similarly, if you are up in New Hampshire playing soccer on a cold rainy day, you probably don't want to wear artificial grass cleats. Sure, your rotational traction will be minimal, but your performance will be seriously compromised, as you will be slip-sliding all over the field.

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In **Table 2** (shown above), the researchers listed each of the six cleats and the amount of rotational traction generated by each cleat. Tiempo SG led the charge with a mean of 52.2 newton-meters of force, followed by Mercurial FG, Magista FG, Tiempo FG, Hypervenom FG, and Tiempo AG. Red values indicate high rotational traction (increased risk of injury), while green values indicate low rotational traction (decreased risk of injury).

That being said, my best advice would be to do some digging. Where are you located? What is the climate? What types of grass are prevalent in your region? If you play on warm-season grass, you may want to avoid cleat types listed with red values (>46 Nm). Likewise, if recovering from an ACL injury, you may want to initiate your return to sport process in cleats listed with green values (<43 Nm).

While this particular research article certainly has its limitations (as do most), it is an excellent start to
---- che conversation. It also helps pave the way for future research investigating optimal traction levels for different sports and field positions. Furthermore, it begs for continued examination of different playing surfaces, soil types, and grass species to understand shoe-surface interaction better. While this article only investigated natural grass, please stay tuned for a future post regarding the ongoing grass vs. turf debate.

Thanks for hanging with me, and until next time, be well!

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6. Hall Je the Unicleat hemicleat sensation.

Published by Julie Hubbard, PT, DPT, MS, CSCS

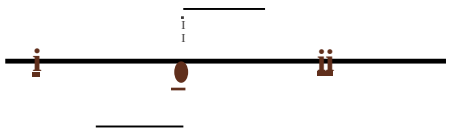
Julie is a physical therapy doctor serving the Greater Boston area. She earned her clinical doctorate in physical therapy from Northeastern University. Before PT school, she played six seasons of NCAA Division I women's soccer and was a member of various semiprofessional teams in the United States and Canada. Her mission is to help clients meet/exceed their rehabilitation and sports performance goals. She enjoys distance running, strong coffee, boxing, and playing with her nephews when not working. View all Posts by Julie Hubbard, PT DPT, MS, CSCS

Translational and Rotational Motion

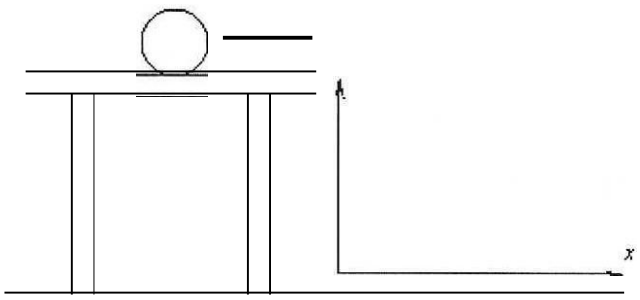
Translational Motion

Translational motion is the motion by which a body shifts from one point in space to another. One example of translational motion is the motion of a bullet fired from a gun.

An object has a rectilinear motion when it moves along a straight line. At any time, *t*, the object occupies a position along the line, as shown in the following figure. The distance *x*, with an appropriate sign, defines the object's position. When the position of the object at a particular time is known, the motion of the particle will be known and generally is expressed in the form of an equation that relates distance *x* to time *t*, for example, $x = 6t - 4$, or a graph.



Motion in two or three dimensions is more complicated. In two dimensions, we need to specify two coordinates to fix any object's position. The following figure shows a simple example of projectile motion: a ball rolling off a table. Let us define the horizontal direction as the x-axis and the vertical direction as the y-axis. Consider a ball initially rolling off a flat table with an initial velocity of 10 m/s.



While the ball is on the table, we observe that the initial x-component of velocity (vax) is ten *mis* (constant), the initial y-component of velocity is O *mis*, the x-component of acceleration is O mls^2 and they-component of acceleration is O *mls*^{2}. The components of acceleration and velocity are those parts of the velocity or acceleration that point in the *x* or *y* direction. Let us observe what happens the instant the ball leaves the table. The initial velocity in the they-direction is still zero, and the initial velocity in the *x*-direction remains ten rn/s. However, the ball is no longer in contact with the table, and it falls freely. The gravitational acceleration of the ball is down. In this case, the motions in the horizontal and vertical directions should be analyzed independently. Horizontally, there is no acceleration in the horizontal direction. Therefore, the x-component of velocity is constant.

$$a_x = \mathbf{0}$$

$$vx = \mathbf{constant}$$

$$x = Vol$$

In the vertical direction, there is an acceleration equal to gravity.

Therefore, the velocity in the vertical direction changes as below.

$$ay = g$$

$$Vy = V\square y + gt$$

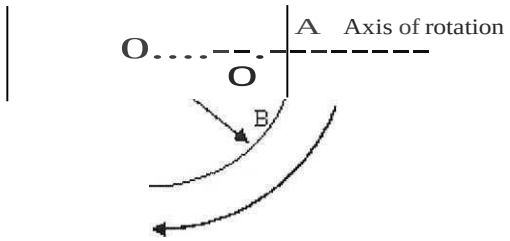
Rotational Motion

Rotational motion deals only with **rigid bodies.** A rigid body is an object that retains its overall shape, meaning that the particles that make up the rigid body remain in the same relative position. A wheel and rotor of a motor are typical examples of rigid bodies that commonly appear in questions involving rotational motion.

Circular Motion

Circular motion is a common type of rotational motion. Like projectile motion, we can analyze the kinematics and learn about the relationships between position, velocity, and acceleration. Newton's first law states that an object in motion remains in motion at constant velocity unless acted upon by an outside force. If the force is applied perpendicular to the direction of motion, only the velocity direction will change. If a force constantly acts perpendicular to a moving object, the object will move in a circular path at a constant speed. This is called uniform circular motion.

The circular motion of a rigid body occurs when every point in the body moves in a circular path around a line called the **axis of rotation**, which cuts through the center of mass, as shown in the following figure.



Uniform Circular Motion

An online simulation to measure the position, velocity, and acceleration (both components and magnitude) of an object undergoing circular motion.

Translational Motion Versus Rotational Motion

There is a strong analogy between rotational motion and standard translational motion. Indeed, each physical concept used to analyze rotational motion has its translational concomitant.

Translational Motion		**Rotational Motion**	
DisP.lacement	dr	Angvlar disP.lacement	d
Velocity.	$V = \frac{dr}{DT}$	Angular velocity!)'.	$_{ul} = \frac{d'}{\_t DT}$
Acceleration	$a = \frac{dv}{DT}$	Angular acceleration	$a = \frac{da;i}{DT}$
Mass	M	Moment of inertia	$I = \int p \quad xr\,1^2 dv$
Force	F=Ma	Torg ue	$r = Ixa$
Work	$W = \int Fdr$	Work	$W = f\, rd¢$
Power	$P = F.v$	Power	$p = f.aJ$
Kinetic energy	$K = \frac{Mv^2}{2}$	Kinetic energy	$K = \frac{Ia.i2}{2}$

Moment oflnertia

Discover the relationships between angular velocity, mass, radius and moment of inertia for collections of point-masses, rings, disks, and more complex shapes.

Torque and Moment oflnertia

Calculate net torque and moment of inertia based on the positions of the objects and the mass of a bar.

Focus on Math

Coordinate Systems

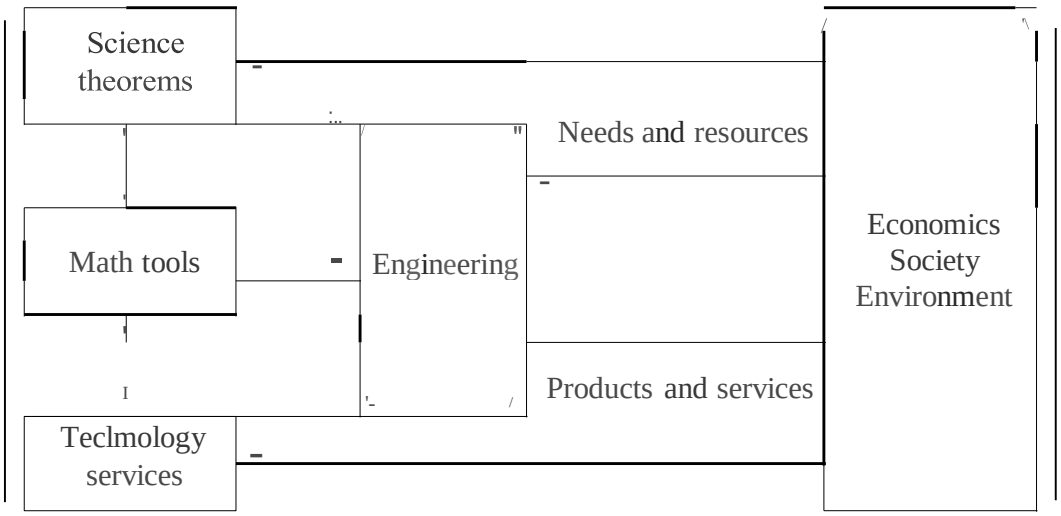
To precisely describe motion, we must be able to say where an object is located within a given reference frame. For example, we can identify a chair in a room by saying it is 2 m away from the door, 3 m away from the window, and 0.5 m away from a table. When we say space is three-dimensional, we mean we need three numbers to locate the position of an object or point completely. A system for assigning these three numbers, or coordinates, to the location of a point in a reference frame is called a coordinate system. We will most frequently use a Cartesian (rectangular) system that describes the position in terms of x, y, and *z* coordinates. However, you can choose the coordinate system you wish to use, orient it the way you want, and place its origin wherever you prefer.

Grade 9 '1-n.lJ.outr. wudom Engineering

Science is about knowing, and engineering is about doing. Henry Petroski

The words "ingenuity" and "engineering" in English and "ingeniosite" and "ingenierie" in French are linked to the same Latin word root, and the verb "to engineer means" to be "ingenious." The term "engineering" was used in the 1300s for a person who operated a military engine or machine such as a catapult or, later, a cannon. The word "engine," in turn, is derived from the Latin "ingenium" for ingenuity or cleverness and invention.

Engineering combines applied mathematical, scientific, and technical principles to yield tangible end products that can be made, produced, and constructed. **Engineering** differs from science in considering requirements, including costs, safety, performance, and resource limitations. Introducing **engineering** into the **G9-12** education integrates science and math concepts into the everyday engineering surrounding us!



A scientist can discover a new star but not make one. He would have to ask an engineer to do that. Gordon Glegg, British Engineer, 1969

A World without Engineers!

John Edward Hall

John E. Hall Technologies LLC & Medicine Hall

2427 Sunset Road

Charlottesville, VA 22903-3627 USA

Phone 1-434-978-4040 john.hall57@gmail.com

U.S. Provisional Patent 63/576,706 filed 5/2/2023

Single Conical, Stud, or Spike cleat in a Universal, Threaded Socket in the Center of the Ball of the Shoe Sole and foot - the Unicleat™ or Hemicleat™ for easy forward Axial and Rotational Traction while avoiding Injury to Knee and Ankle Ligaments; Interchangeable cleats for different sports where cleats are worn.

Over the last seven years, this researcher has studied sports medicine and the need to address injury to knee and ankle ligaments due to clipping in football, soccer, or other contact sports. It is to be noted that the vast majority of injuries occur at the High School level. Some of the best athletes in the Nation are injured when they are learning their contact sport to the tune of 100,000 per year in High Schools. Knee and ankle injuries account for about 95% of injuries, and a lack of protection and prevention causes them. Complete problem comprehension is required before an apt solution can be found. Comprehensive security and prevention of the knee (the most complex joint in the human body) and syndesmotic sprain of the ankle can be prevented in elegant fashion design engineering by use of Knee Shields for Contact Sports™ using the new Dual Stop Bearing (totally plastic) as opposed to the Polycentric Hinge™ which is a hospital product and best used after an injury or break has occurred.

A professional Track Shoe serves as the inspiration for the Unicleat™ or Hemicleat™ solution. Nike is the leading shoe seller in the world. They are ripe for the picking because of the liability and poor design of perimeter studs, spikes, or conical cleats made by all leading sports shoe makers. Research pays off in a big way when a full understanding of a problem is followed by inspiration and development. Of course, the marketing and sales of the new product is the proof.

John Edward Hall, Design Engineer

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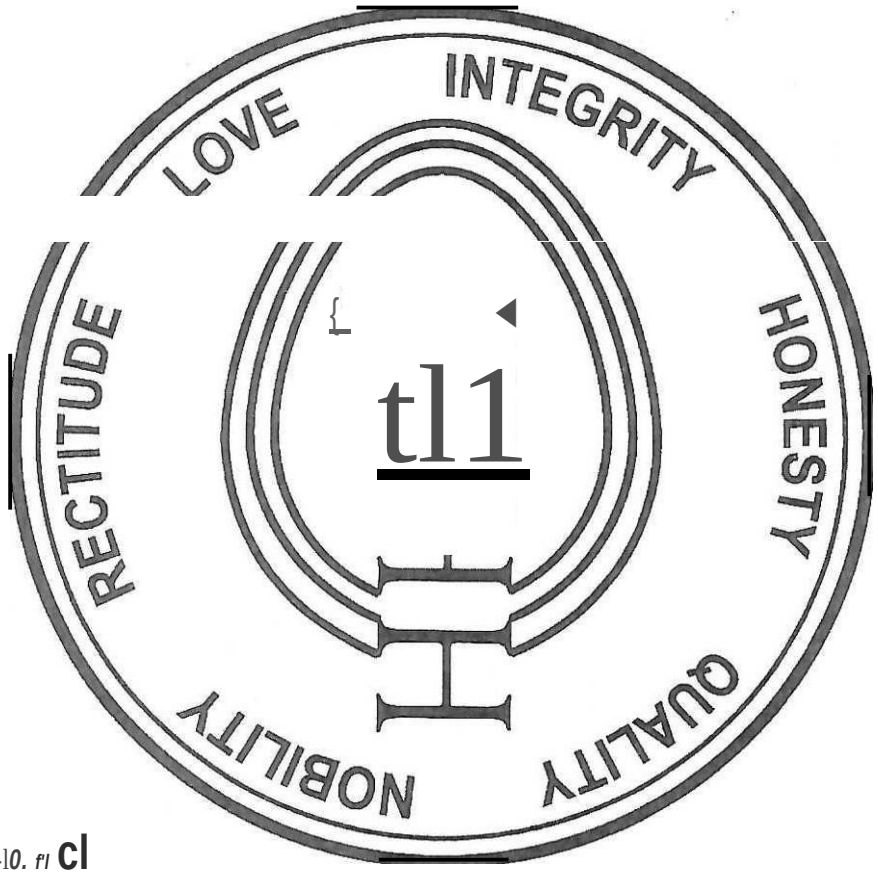

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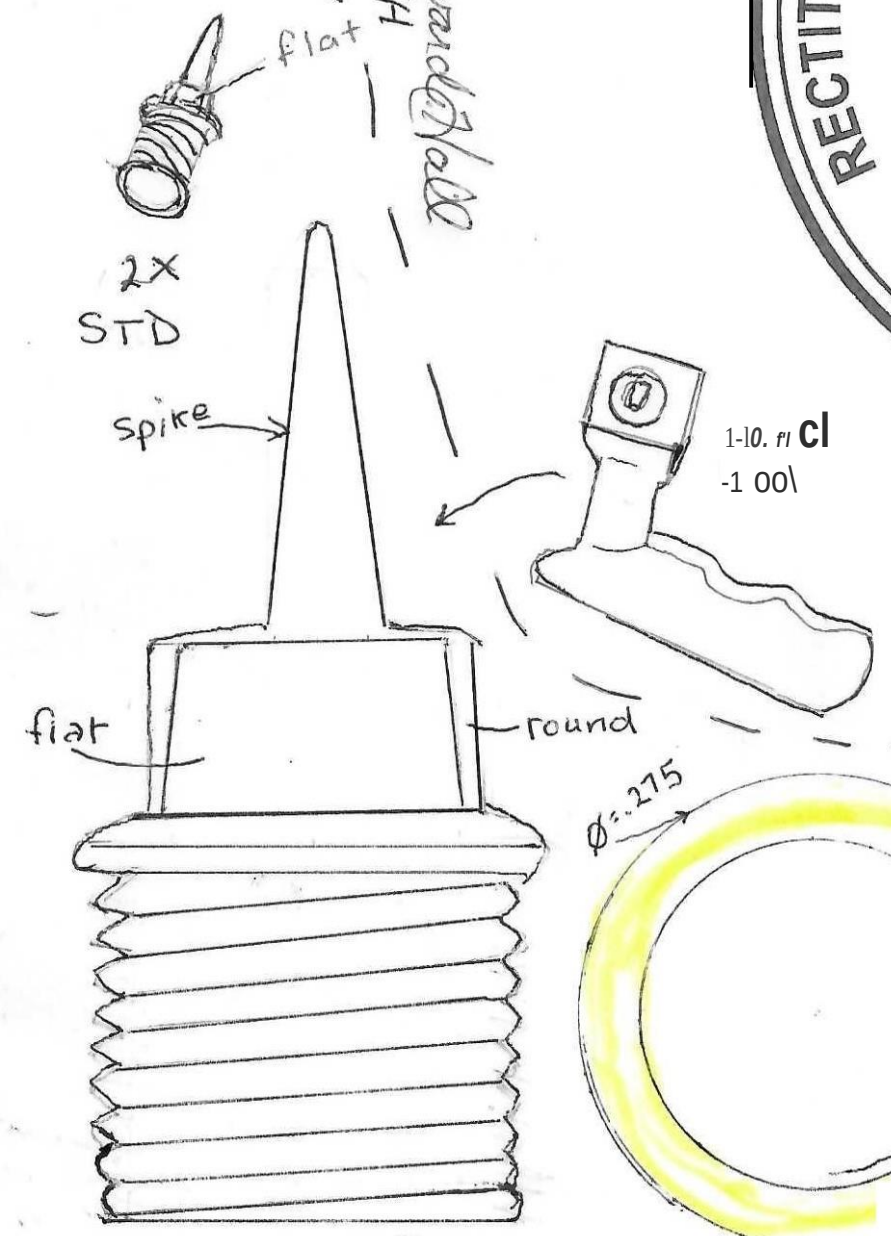

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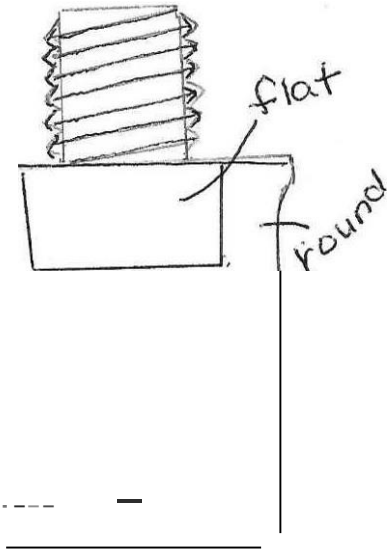

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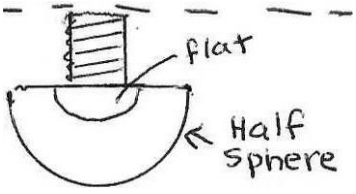

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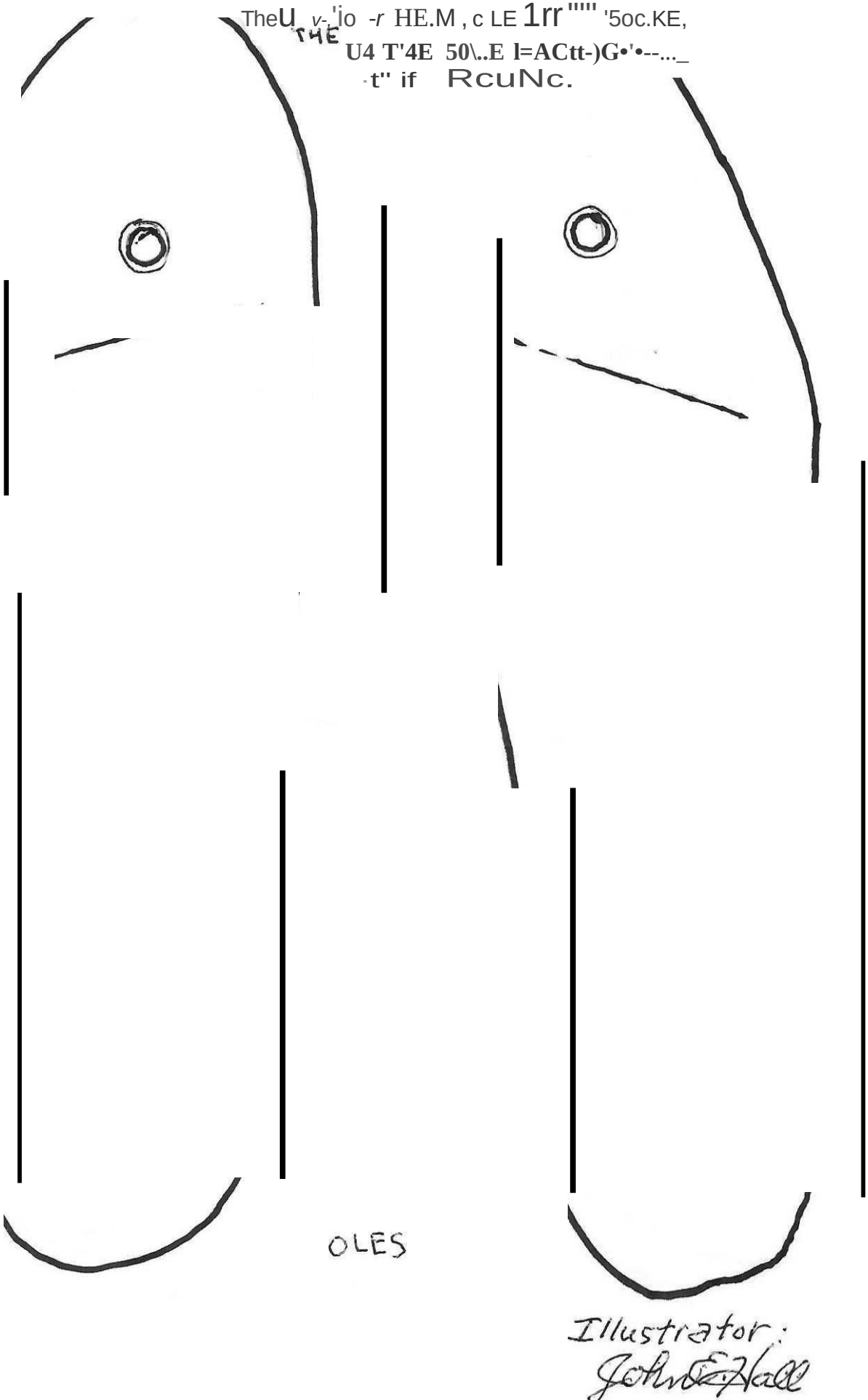

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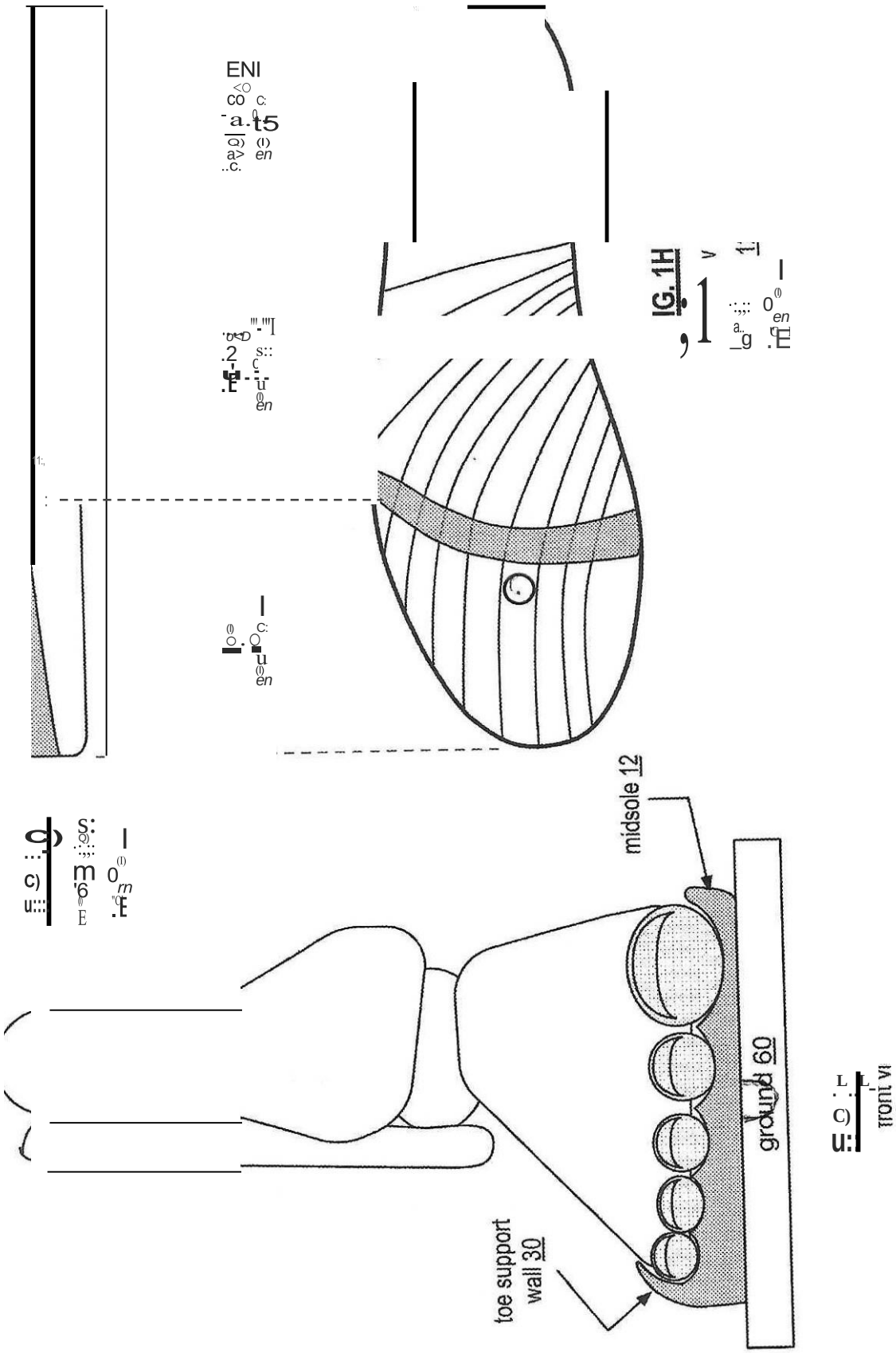
Illustrator:
John E. Hall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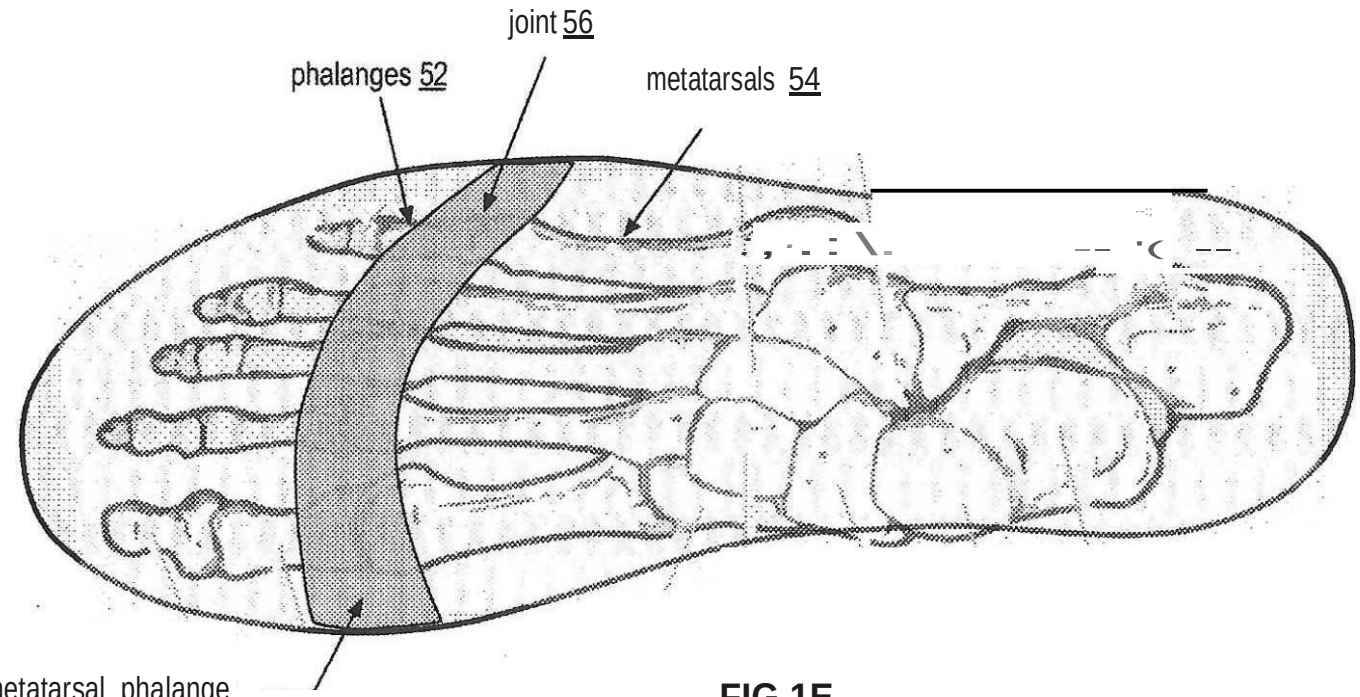

FIG.1E

top view

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