Abstract— Footwear traction is essential for sports like basketball in order to perform swift changes of directions. A huge amount of traction in basketball shoes is one of the factors that may contribute to more non-contact injuries. Therefore the experimenting of many different types of basketball sport shoes traction on the same gaming surface will be tested. The aim of this research is to study the traction of the basketball sport shoes on one type of playing surface to mainly reduce injuries like ankle injuries. A device is built to test the traction, and an experiment is conducted to obtain particular results.

Keywords— Sport shoe traction, sport shoe testing device, traction testing device, pneumatic traction testing, basketball shoe.

1. Introduction

   Traction is very important in sport shoes, but the right amount of traction is more important and too much or too little will cause injuries to athletes. Traction is the amount of maximum frictional force that can be produced between surfaces without slipping [1]. This project particularly is going to be tested only on basketball shoes. The main factors for a traction is a fast start and stop frictional force that can be produced between surfaces without slipping [1]. This device is running on pneumatic principles. This device is quite simple to operate. It can be easily pushed anywhere around to test. Any type of shoe can be tested on this device.

2. Theoretical Framework

2.1 Sport Shoes Traction Effect on Athlete

   Traction of sport shoes is important for the performance and safety of an athlete. Excessive amount of traction increases the risk of foot fixation. Different amount of traction is required for different types of shoes available in the market. The right amount of traction is very important to avoid injuries during sport activities.

   There are four main types of traction which is static, dynamic, translational and rotational. The translational traction basically is the amount of traction that is being resisted for the particular shoe that is being tested to slide. A typical example is that, high translational traction has more traction and low translational traction has less traction, for an athlete. Traction that resists rotation movement when any steps are taken is known as rotational movement. When an athlete is involved in a sport game, having large amount of rotational traction has a higher tendency for foot injury, whereas for small amount of rotational traction will have much lower tendency for foot injury because the amount of grip of the outsole to the ground is less and easier for the athlete to make the next move.

   Besides that, static and dynamic traction explains how it contacts with the shoe outsole and the ground. Static traction is the traction that is resisting for motion when there is zero movement between the shoe outsole and the ground. For example, this type of movement resists the first move of an athlete. Dynamic traction is the traction that is resisting for motion during movement. For example, this type of traction resist for the next movement after one movement is completed.

3. Research Methodology

Building a sport shoe traction testing device was studied. There were many aspects that have been studied and it provided a lot of insight in building a sport shoe traction testing device. The device that is available in current market and information that is available is mainly on football and soccer shoes. The similar concept was used to build this device to test basketball shoes.

   It can be seen that different turf and different amount of load exerted by a players affects in the cause of injuries during sport activities. Sometimes this injuries might lead athlete to lose their ability to play sports either for a long time or lifelong. Thus the studies on human gait cycles (human movement) were very vital to understand the main aspects that are connected to building this sport shoe traction testing device.

   From all the studies and finding, solution to build a traction testing device has been achieved. A clear understanding on how will the sport shoe traction testing device works. It is simple and results should be accurate.

   In building a traction device it is important to have a pressure regulator. This is because it independently regulates the force going to the two actuator cylinders. These two actuator cylinders are...
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The vertical force is pressured externally. The force stays constant during the test. The force amount can be seen from the air pressure gauge. For horizontal force the pressure in converted into force taking consideration of the pneumatic cylinder diameter and stroke distance.

The amount of traction need to be significant, which is not too much or too little to reduce the number of injuries that, happens during basketball sport activities.

Slip resistance is calculated by horizontal force divided by the vertical force. The ideal amount of slip resistance should be around 1.5 to 3.0.

Different types of shoes have different amount of traction, thus shoes makes an important factor to avoid injuries. Different types of outsole of a particular shoe is usually made for particular sports where is has the right amount of traction on the particular ground where the sport is being played.

The amount of human weight also plays a big different for shoe traction as more weight can reduce the amount of traction in a particular ground. Thus, for many times of sports there are different shoes used that is suitable for the particular sport which in return will reduce the cases of injuries to the athlete.

4. Results

<table>
<thead>
<tr>
<th>Horizontal Force(N)</th>
<th>Vertical Force(N)</th>
<th>Slip Resistance(N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>277.33</td>
<td>544.63</td>
<td>0.51</td>
</tr>
<tr>
<td>554.63</td>
<td>544.63</td>
<td>1.00</td>
</tr>
<tr>
<td>831.93</td>
<td>544.63</td>
<td>1.52</td>
</tr>
<tr>
<td>1109.26</td>
<td>544.63</td>
<td>2.04</td>
</tr>
</tbody>
</table>

Table 1 Slip resistance results

5. Discussion

From the results above it can be seen that the vertical force is constant throughout the experiment as it significant as human weight during sport activities. As for the horizontal force it can be seen that it is being changed. As this force signify the amount of force needed to move the shoe.