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Preventing Weightlifting Injuries by Barbell Modifications

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Weightlifting is a form of exercise that is second to only walking in terms of popularity among the American population [1]. Of these people, roughly 800,000 of them end up in emergency rooms due to an injury related to weightlifting each year [2]. A majority of the time, these injuries are due to improper technique during a lifting movement. The bench press is a common, yet seemingly hazardous, lift that can result in shoulder, chest, or arm injuries. An imbalance in the way a user lifts the barbell with each arm leads to a more concentrated load on a single muscle or muscle group, which leads to frequent injuries by users that lift with improper technique. It is believed that a device that could measure and display real time imbalance of the barbell during exercise would be beneficial to the user in prevention of injury.

There are plenty of devices that can detect biometric data during a lift that are already available on the market. The vast majority of said devices capture data using a system of accelerometers and gyroscopes, and send it to an app on the users phone for a succinct evaluation of their lift. A good example of this type of device is the *BarSensei*, which is a one ounce device that straps on to a barbell and can measure barbell speed and muscle power/force [3]. There are the occasional devices using cameras or cables that can also track lifts. A patent for a multi-functional weight rack and exercise monitoring system for tracking exercise movements utilizes an array of cameras to obtain similar data as described above [4]. However, there has yet to be a device that can show the user - in real time - the efficacy and possibility of failure for their lift. The team’s goal is to use a novel technology, unused in the realm of barbell devices, to provide a low cost design for lifters who are concerned about their safety to use.

The design consists of three separate attachments to the barbell. On either end, a mechanism that acts as a clamp with an affixed ultrasonic sensor records the distance from the barbell to the ground and promptly sends the data (wirelessly) to the main unit, positioned between the user’s grip. After calculating the percent difference between the two distance measurements and estimating the angle of the barbell relative to the ground, the data will be displayed in real time to the user. The novel use of ultrasonic sensors and innovative real time display to the user make this device unique, but tests must be ran to determine if this device is fit for sale on the market. The device will be compared against real world measured values to determine it’s accuracy regarding distance sensing and barbell angle. Once it has been

determined to be functional, a subsequent test with human subjects will be performed to gauge it’s ability to prevent injury: Data from experienced lifters and new lifters alike will be gathered with and without using the device to see if rates of injury go down and to acquire user input for further improvements.

References

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