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# Lift Smart, Lift Heavy

by

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of  
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**Abstract**

CrossFit and weightlifting have been on the rise as a popular sport of choice for men and women. It can be intense and taxing on the body, but also fun and rewarding. There's no better feeling than when you finally hit a new personal record, lifting more than you ever have before. With weightlifting, however, come the "mystery bruises" that you don't realize you're giving yourself until you get home and look in the mirror. That is why I am going to attempt to answer the question of: How might we design athletic gear that protects weight lifting and CrossFit athletes in areas that bruise from repetitive contact with the barbell?

Through research it has been found that the most commonly impacted and bruised area of the body when weight lifting is the collarbone. The goal of this product is to provide an effective and non-intrusive, impact resistant solution to cover and protect the collarbone. The proposed Catch Guard is worn around the athlete's neck and extends down the chest to cushion the blow of the barbell on the collar bones.

## **Introduction**

Athletes all over the world participate in weight lifting as a sport in itself or as a means to train and better their fitness for other sports. There are over 500,000 athletes who participate in the sport of Crossfit in the world, all of which participate in weightlifting in one way or another. Many of these athletes have expressed that when weight lifting, specifically when the barbell is resting in the front rack position, a position where the athlete is resting the barbell across their chest and shoulders with their hands on the bar and their elbows up and in front of them, they experience bruising, redness, soreness, or discomfort. These feelings of discomfort are caused by the barbell making contact with the body either at a lighter weight in a repetitive manner or at a significantly heavier weight for fewer reps. These marks left behind, specifically on the collarbone, can impact an athlete's performance if they are trying to avoid them or when they get too painful to continue the lift properly. The athlete may decide to not give a workout their full effort or they may try to change their form which in turn could cause a more serious injury. Bruising and redness around the neck area can send the wrong message when outside of the gym and can make for an awkward situation or conversation with a concerned peer.

The proposed Catch Guard is specifically designed to eliminate or significantly reduce bruising, redness, and discomfort around the collarbone for both men and women while still being safe to wear, stylish, nonintrusive, and affordable.

## **Literature Review**

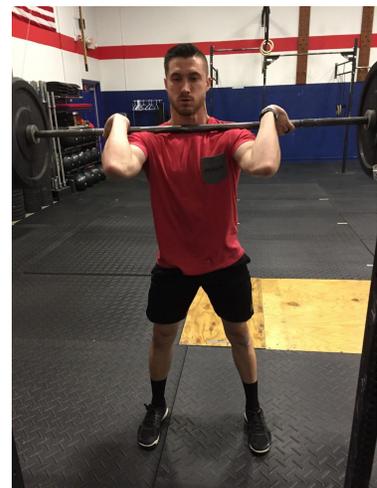
The literature reviewed when exploring the weightlifting topic was mostly articles found on online fitness journals that were written by coaches or professional athletes. These online fitness journals were: Crossfit 8 Mile's blog and *Trek Tech Blog*. The literature was helpful in finding a place to start when gathering information for the Catch Guard. The articles talked about the importance of form when lifting and how practice could reduce the amount of bruising. However, the biggest thing that was taken away from these articles was that the amount of

bruising and discomfort depends on the athlete. Every athlete is different and therefore every athlete's body will react differently to the impact of the barbell.

## Research

Over fifty athletes were interviewed and surveyed in order to gain an extensive amount of knowledge on the topic of weightlift, discomfort, and the different ways people combat that discomfort. The athletes all varied in skill level in regards to their sport of choice. The athletes ranged from professional career athletes, such as the number one fittest American Crossfit women Kari Pearce and retired NFL player John Booty, to those who have been working out for less than a year.

In the preliminary research of reading and reviewing articles and literature on the topic of bruising and discomfort in athletes when performing movements in the front rack position (see photo at right) it was apparent that many people believe the discomfort comes from a lack of good form and practice. After conducting interviews and observations, however, it has become clear that this is not always the case. One of the questions asked of athletes was:



“Which movements, if any, cause bruising or redness when working out?” This question received twenty-four different answers with some athletes giving more than one and most of them repeating the same answer as another athlete. Of the eighty answers given, thirty-one people said that the Clean, a movement where the barbell starts on the floor and finishes resting on the athletes front rack, leaves bruising and redness, and forty-three people gave an answer that has the barbell hitting the front rack position at least one point during the movement. Even professional athlete Kari Pearce stated, “A lot of times when I do cleans I'll get bruises on my neck.” Hearing Pearce, an athlete who has spent countless hours perfecting her form, state that she too experiences bruising, confirmed that it is not always a lack of skill and experience that causes the discomfort. Every individual is built

differently meaning that everyone's collarbones stick out to different positions and depths and can, therefore, be more likely to receive bruises no matter the amount of training dedicated to perfecting one's form. Of the eighty answers given only seven athletes stated that they receive no bruising at all when working out.

## Methodology

The final design was developed and edited through many different methods of research and gathered information. Reviewing literature and fitness journals was the starting point of the research process. After reviewing the journals, surveys, and interviews were conducted in order to find out where real athletes felt pain and discomfort while weightlifting. After gathering information from over fifty athletes, sketches, ideations, and a prototype for the Catch Guard were created. After that came another version and another version and another version for further refinements to the product.



After creating multiple different options for prototypes, the testing and editing began. The collar like model was selected to move forward based on comfort, ease of application, and impact on the wearers range of motion. The first prototype was made out of a yoga mat and multiple copies were cut. The prototype was taken to Crossfit RSG to be tested out with the athletes and coaches who work out there. After testing and getting feedback from the users', changes were made to the Catch Guard to further improve the product. This method of testing and editing is how we came up with our final prototype.

## Design Goals

The goal for the design of the Catch Guard is to design a lightweight, unobtrusive, and stylish garment that protects the collarbone of the wearer from the impact of the barbell without

restricting the athlete's full range of motion. The Catch Guard features a “quick release” mechanism for fastening it around the wearer's neck. The mechanism allows for the wearer to easily apply and remove the Catch Guard should they need to in the middle of a workout.

### **Testing and Validation of Preliminary Designs**

The validation for the Catch Guard comes from the fact that over half of the interviewees stated that they suffer from bruising and redness when they perform movements with the barbell in the front rack position. When testing the Catch Guard, the test subject stated that they could feel a drastic difference within the very first lift when compared to not having any protection at all. After doing a workout featuring Cleans the athlete noticed that they had no reddening or soreness whereas they most likely would have bruised without the protection provided from the Catch Guard.

### **Summary**

The design started as a large rectangular shaped pad that covered the wearer from shoulder to shoulder and fastened around the arms with a strap on each side. Through testing and observations of different people trying to put the prototype on it evolved to the collar like ring it is now.



### **Final Design, Features, Benefits, User Scenarios**

The final design of the Catch Guard by Lift Smart, Lift Heavy is a collar-like garment that goes around the neck and extends about two inches down the chest in order to protect the collar bones. The piece is made up of an impact resistant foam core that is covered in neoprene. The collar uses a specially designed fastening mechanism that is a hole and peg mechanism that is



made of a silicone material in order to avoid injury if it gets between the barbell and an athlete's body.

A user will use the Catch Guard any time they are lifting weights and the barbell is resting in the front rack position or coming in contact with the collar bones. This includes but is not limited to when an athlete is performing Cleans, any type of shoulder to overhead, and front squats. An athlete can also turn the Catch Guard around and wear it while doing back squats to prevent bruising on the back of the neck.

### **Discussion on how final design and/or outcomes address problem statement**

The final design for the Catch Guard by Lift Smart, Lift Heavy is a collar-like garment that is made out of an impact resistant foam core and is covered in a layer of neoprene. The collar is worn around an athlete's neck and sits right on top of the collarbone and clavicle area. The Catch Guard is thin and flexible so that it is not intrusive and does not get in the way of the athlete performing a lift. The guard can come in all different colors because it is covered in neoprene and sew together. This gives it a more stylish and personalized feel so the athlete wearing it feels like it goes with their image and style.

A main feature of the Catch Guard is the quick release mechanism used to hold the guard in place around the wearer's neck. The mechanism is made up of a two peg and whole system which allows for a strong connection by having two points of contact. The pegs are made of a skin safe silicone called Dragon Skin from the company Smooth On. The silicone allows for the pegs to have structure and strength but is still somewhat malleable should the mechanism somehow get between the barbell and the wearer. If this were to happen the pegs would not be able to puncture the wearers skin and cause a potentially dangerous situation. The pegs are designed to be big enough that a wearer can easily get them through the holes on the other side of the collar while the mechanism is behind their neck and without having to see what they are doing. It is also extremely easy for a wearer to remove the Catch Guard when needed because all

they have to do is simply pull the end of the side with the holes and it comes off for a quick release. This is also a built-in safety feature to the Catch Guard. Should the guard somehow get caught on something such as the barbell while it's in use it will come right off the wearer without harming the athlete in the process.

All of these components of the Catch Guard work toward the goal of improving athlete comfort while lifting and reducing bruising and redness on the collarbone/clavicle area.

## **Conclusion**

The next step is to move forward with the final design and file an application for a patent. After the patent application is filled and "patent pending" can be claimed and a business model has been completed the product will hit the market in an attempt to help athletes all over the world to protect their collar bones when weightlifting. After this product is underway, the next project will begin. The next product idea is for a form tracker that consists of pressure sensors in an athlete's shoes that tracks the balance and weight distribution of an athlete when lifting or training. These pressure sensors can also be paired with motion sensors that are installed on an athlete's barbell to track the movement patterns of the barbell when lifting thus giving the athlete as much feedback on their form as possible.

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