



PROTECTING ANKLES

EXO-L LIFE STORY



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Initial reason for development

It was 18 years ago that the inventor of the EXO-L, Marcel Fleuren, 15 years old, was playing soccer. During a training he sprained his ankle and was not able to continue. This was not his first time he sprained his ankle. The general practitioner sent Marcel to a specialist. The specialist had just one advice. "Your ankles have been sprained to many times and I can't do much, you have to quit playing soccer and all other risky sports." As a young soccer player with potential to play on a high level, his dreams were diminished with this statement.

The birth of the EXO-L

Although Marcel his ankles were not that good, his brains functioned well and he made it his objective to come up with a solution for his own ankle problem. After graduating from high school he started his study, industrial design engineering at the Delft University of Technology. As soon as he got the chance he started working together with the Erasmus Medical Center in Rotterdam to get a good understanding of how the ankle functions. He found that in 98,5% of the cases the talofibularanterior ligament (tfa – ligament) was damaged during a sprain injury (Van der Ent, 1984). In only 1,5% of the cases the tfa ligament was not damaged, while other ligaments are damaged. Based on this knowledge he figured that it would be good to simulate this tfa-ligament on the outside of the ankle, with the hypothesis that this could stop the sprain from happening. He started developing a product that has a cord running from the foot to the lower leg in the same direction as the ligament. To attach the cord he needed 2 attachment points, one on the shoe (foot) and one on the ankle (lower leg). Based on this idea of mimicking the tfa ligament, the EXO-L was born (Molenbroek, Kleinrensink, Fleuren, & Minnoye, 2011).

EXO-L to the market

To further develop the product into a market ready product EXO-L conducted a research with the first 50 users. The objective was to test how well the product performs in a real sports situation. The product was embraced by a large part of the research group. A lot of people were really enthusiast about the principal and the benefits of using the EXO-L. A summary of the results are published in the Dutch paper 'Sportgericht' (Fleuren, Molenbroek, Kleinrensink, Verschoor, & Zaanen, 2014). From this point onwards the product was patented worldwide and a 3D-scan to 3D-print software was developed to be able to help as many people as possible.

Questions from the market

With the enthusiasm from the first research group, EXO-L entered the market. With entering the market, the following questions arose:

What happens with the forces that are required to stop the sprain?

To what extend do users experience freedom of motion?

To what extend experience professional athletes comfort (while wearing EXO-L long term)?

How well does it prevent ankle sprain injuries?

Together with a human movement scientist and the Erasmus Medical Center EXO-L started doing research on all of these questions. And at the moment of writing this timeline (June, 2018) we are still learning every day. And this is what was learned from the questions so far:

Further research

Freedom of motion in relation to negative side effects

The research showed that the EXO-L restricts excessive inversion while having a complete freedom of motion towards other directions (Kleipool et al., 2015). These results are completely in accordance to the recommendation of a later research that quotes: *“The use of a preventive ankle support increases the vertical ground reaction force during a landing protocol. This change represents deterioration in the buffering characteristics of the joint. An ideal ankle support design should limit the excessive joint motion of ankle inversion, while allowing a normal range of motion, especially in the sagittal plane.”* (Niu, Feng, Wang, Jiang, & Zhang, 2016). A lot of sport federations but also some large corporates share the opinion that a brace has negative side effects and argue that a brace results in a higher risk of knee injuries, which is supported by literature as well (Fong, Troy Blackburn, Norcross, McGrath, & Padua, 2011). EXO-L offers ankle protection without these side effects.

Forces on the lower leg

The forces that stop the sprain from happening will be transferred from the foot to the lower leg. But different from braces, the direction of the forces are in a longitudinal direction (a natural direction) on the leg. In this way, it is similar to how a muscle or ligament transfer the forces and direction to stop the sprain, but with the big difference that now the ankle will not sprain and the ligament is not damaged. This doesn't exclude any other injury from happening. When wearing no protection or wearing a brace or the EXO-L, the lower leg can still suffer from other injuries like an eversion trauma or syndesmoses injuries. The EXO-L will always protect the outer ligaments from damaging.

Effective protection of the EXO-L ankle brace

Besides the functional part of the freedom of movement, the EXO-L users give feedback that they don't feel the EXO-L around the ankle during sports because it only works when spraining the ankle. More important than this comfort, is the protection the EXO-L gives the user. A user research amongst 120 customers that used the EXO-L for over a year was

conducted. Together these users practiced sports for 30.000 hours and sprained their ankles 6 times, which result in 0.2 sprains per 1000 hours sports (EXO-L, 2015). Compared with literature we have 15 times less ankle sprains then without protection (Verhagen, Van der Beek, Bouter, Bahr, & Van Mechelen, 2004), while a brace results in approximately 2 times less sprain injuries than wearing no protection (Verhagen & Bay, 2010).

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Achievements

