



## Crocs Silver Cloud under the microscope Summary

### A study into the specific properties of Crocs Silver Cloud

Target group: diabetic - arthritic clients/patients and foot specialists

Does the shoe protect sensitive feet?  
Can the shoe be used both preventively and curatively?

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**Study conducted by Axium - Buchrnhornen independent research institute for gait-related issues. Researcher: W. van Bakel, movement scientist/stress physiologist in Eindhoven, working as a researcher in the biomechanics laboratory at Buchrnhornen orthopaedic techniques and author of "Voeten rond de wereld, een wereld rond voeten" [Feet around the world, a world around feet]. Axium Buchrnhornen provides gait analysis and advice to top athletes worldwide. The study was conducted in collaboration with the director of Crocs Europe, Mr. D. Wijsman and manager of Crocs medical Europe Mr. T.M. Hoeven.**

#### Product history

Crocs started in Boulder Colorado, USA in the summer of 2002. George Boedecker, Scott Seamans and Duke Hanson decided to develop and market an innovative type of footwear. The shoe was designed and produced by Foam Creations. The original Croc - a boating shoe with a slip-resistant, non-marking sole - was followed by the 'beach' model. This was introduced at the Florida Boat Show in November 2002. The response was very enthusiastic and within two days the shoes were completely sold out. A few months after this, Eddie Scott (now director of Crocs Rx) came in contact with the shoe. He saw that the normal Crocs suited as a very nice platform for a diabetic shoe. From that point on he started the medical division of Crocs and build it up to be the number one selling medical shoe line in the United States.

#### Research objective

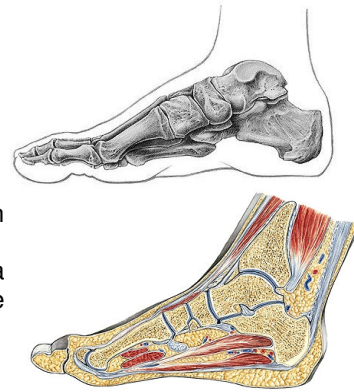
The aim of this study was to test and analyze the specific properties of this new and controversial product aimed at preventing damage to diabetic and arthritic feet. We at Buchrnhornen want to know if the product really works. Does the new Silver Cloud reduce the mechanical overpressure under the feet of diabetic and arthritic patients to an acceptable level?

#### Shoes in general

Proper shoes do not have to be expensive, as long as they fulfil a number of conditions. The shoe was initially developed around the foot, to protect people from external influences. As the shoe has evolved over the years, it has increasingly become a fashion item. It was only later that people began to consider the biomechanical and orthopaedic applications and specific function of a shoe besides its protective or fashionable function. The general image of a good shoe was born. The shoe must protect the foot from external influences; it must be comfortable and mechanically sound. Studies undertaken in 2005 relating to feet, shoes and gait described in the book "Voeten rond de wereld, een wereld rond voeten" by W. van Bakel started people thinking.

People started to reflect that a shoe that entirely encloses a foot and restricts movement is not what one expects of a shoe (exceptions related to impairments). It is becoming increasingly accepted that a shoe must give the foot room to move and let the foot do what it was designed to do.

The foot consists of 26 bones, ligaments, tendons and hinge joints. This complex entity allows us to move around without falling over. Feet cushion the movements of the body and absorb pressure during physical activity, while the bones, ligaments and muscles allow us to move. Sometimes there may not be enough cushioning when pressure is put on bare feet. In that case injuries can be expected. A shoe can play a vital role here on terms of shock absorption. The foot is the body's foundation for walking and standing. Just like a building: if the foundation is weak, problems will occur further down the road.



### **Crocs Medical Rx**

The regular Crocs are aimed at leisure and professional activities, also GDL (general daily life). The Crocs Medical Rx line however targets a specific group of users. The shoes are said to be designed for general foot problems, diabetic and arthritic feet. The one that promises the most is the Silver Cloud.

The shoe gives protection to the sensitive feet of diabetic and arthritic patients. These patients must prevent damage to their feet from external influences, pressure under the feet caused by excessive pressure/forces and from bacterial protection. The Silver Cloud claims to fulfil these requirements. In this study, the mechanical properties will be outlined.

In technical terms, the Silver Cloud allows the foot to move and provides the right cushioning support. This last feature is extremely important. Poor cushioning often results in injury and this aspect will be investigated.

### **Pressure measurement as theme for study**

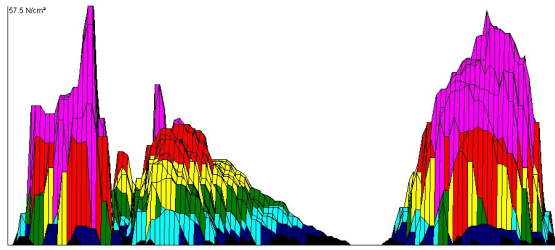
The following test was conducted among  $\pm 150$  people (n.150). They were asked to walk on a pressure plate (Novel GmbH).

We also measured the pressure under the foot using an inlay measuring system developed by Axium – Buchhornen. The first five trials were conducted barefoot, followed by five trials with daily shoes and five trials with Silver Clouds. These measurements were averaged to give a realistic picture of found pressure during walking.

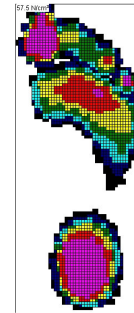
When walking, the feet are placed on the ground and taken off again. Forces are therefore exerted from the floor onto the foot.

During ground contact, the foot absorbs these forces and conducts them 'upwards' to the rest of the body. In reality, the forces are distributed over the contact surface that the foot has with the floor. Therefore we speak about foot pressure and not foot forces. The pressure distribution under the foot is dependant on the changing contact area. Bones move, ligaments are pressed in or stretched. If the mechanism is interrupted, it will be expressed in increased pressure in some areas under the foot and reduced pressure elsewhere. By using special, recently developed measuring techniques, the foot pressure can also be measured during standing and walking. This data is combined with video recordings and ultimately analysed in relation to the symptoms. Foot pressure measurements make it possible to 'read' whether joints are blocked, whether muscles are working optimally, or even if there is a difference in leg length. Not only is the level of the pressure important, but also where and when pressure occurs when walking. Besides measuring under bare feet, the pressure in the shoe can be read. To do so, there are special pressure measuring inlays and an ambulant data logger. The graphs below show the pressure level according to colour: the warmer (more purple) the colour, the higher the pressure.



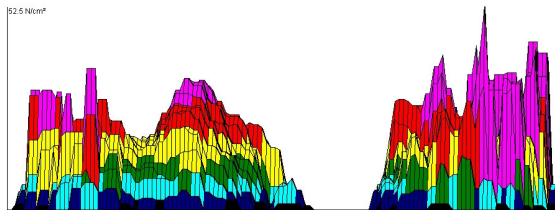


**Pressures under the foot**

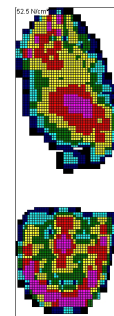


Pressure forces exerted on bare feet were averaged for 150 people. High pressure under the right heel, forefoot and toes. 58 N/cm<sup>2</sup>.

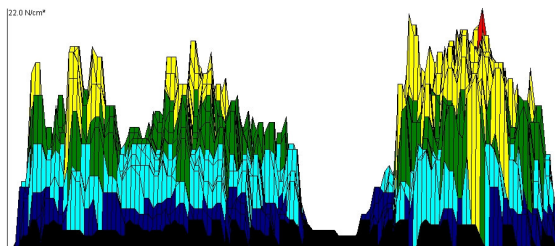
Measurement under the foot. The purple colours indicate high pressure, dangerous for diabetic and arthritic feet.



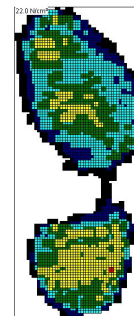
**Pressures under the daily shoe**



Measuring pressure with daily shoes. This picture shows a better distribution of pressure under the foot and considerably lower pressure/forces. It measures and average pressure of 51 N/cm<sup>2</sup> under the foot. High peak pressure can be found, particularly underneath MTP 2 and 3. This is a risk area for impairments and ulcerations.



**Pressures under the Silver Cloud**



The Silver Cloud provides excellent distribution of pressure under the foot. No peak pressure can be found and an average pressure of 22 N/cm<sup>2</sup> is very low. The cushioning of the Silver Cloud helps prevent overpressure under the foot.

## **Conclusion**

Although I was a bit surprised with the look of the Silver Cloud, my doubts changed after seeing the first results from testing. The conclusion is that the Silver Cloud indeed is a functional shoe for diabetic and arthritic patients. Good comfort, shock absorption, stability and support for the foot show that the shoe does what Crocs Medical Rx claims it does.

By reducing high pressure and forces, people with sensitive feet such as diabetic and/or arthritic patients can benefit from wearing these shoes.

