



## **A Study on Posture Corrective Shoe Soles.**

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### **ABSTRACT**

By offering more support and padding for the feet, ankles, knees, and back, posture-correcting shoe bottoms aim to improve posture and reduce foot and joint pain. Numerous physical problems, such as muscle strain, joint discomfort, and spinal disorders, can be brought on by poor posture. These shoe soles assist alleviate posture abnormalities by uniformly transferring body weight across the feet, which enhances overall alignment. Due to its availability in a range of forms, dimensions, and materials, posture-correcting shoe bottoms are a versatile complement to any footwear collection. Posture-correcting shoe soles can be a successful solution for people wishing to improve their posture and lessen physical discomfort, whether for simple support or extensive orthotic correction.

**Keywords:** Posture, Shoe Sole, Health, Technology

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### **Introduction**

Posture correcting shoe soles are a type of shoe insert designed to help improve your posture and alleviate foot and joint pain. These shoe soles are specially designed to distribute your body weight evenly across your feet, providing additional support and cushioning for your feet, ankles, knees, and back.

Poor posture can lead to a range of physical issues, including muscle tension, joint pain, and even spinal problems. By wearing posture correcting shoe soles, you can help to correct any imbalances in your posture and improve your overall alignment.

These shoe soles are available in a variety of shapes, sizes, and materials to suit different types of shoes and foot shapes. Whether you're looking for a simple insole to provide additional support or a more advanced orthotic insert to correct a specific foot issue, posture correcting shoe soles can be a valuable addition to your footwear collection.

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### **Literature Review**

1. (Chander, 2021)An analysis of postural control strategies in various types of footwear with varying workloads. Footwear and physiological workload have both been shown to influence postural stability. Analysis of postural techniques during a sensory organisation test (SOT) can help researchers better understand postural control behaviour. The research offers previously unreported postural strategy ratings from each SOT condition when exposed to varying workloads in various types of footwear from two different completed investigations. The first study looked at postural methods in several types of footwear [Crocs (CC), flip-flops (FF), and Vibram five-finger (VIB)] before and after a low-intensity workout and study 2 in military footwear.
2. (Wade, Garner , 2015)The influence of occupational footwear on dynamic balance perturbations. Occupational footwear is designed for safety and has been found to affect balance, particularly in workplaces where the human body is subjected to destabilising forces from both internal and external perturbations
3. (Federolf , 2012)The effect of footwear on postural control in bipedal quiet stance. Studies of the occurrence of falls in senior populations found that going barefoot was more dangerous than going shod, implying that footwear has an effect on the postural control system. So, the aim of this study was to objectively evaluate the postural movements made during calm posture in order to determine the effects of footwear on the postural control system. 29 participants' postural motions were captured using a common marker-based motion analysis technique. Bare feet, casual athletic shoes, and so-called unstable shoes were the three types of footwear that were assessed. The posture vectors, which are made up of the 3D coordinates of all markers, were analysed using principal component analysis (PCA) to identify the one-dimensional (1D) principal movement (PM) components.
4. (Bamberg; Benbasat , 2008)Gait Analysis Using a Shoe-Integrated Wireless Sensor System. In this, we'll go through a wireless wearable system that was created to offer quantitative gait measurement outside of the typical motion laboratory. The sensor array consists of two dynamic pressure sensors, two bidirectional bend sensors, three orthogonal gyroscopes, three orthogonal accelerometers, four force sensors,

and electric field height sensors. The "GaitShoe" was created to be worn in any shoe without affecting gait and was intended to gather data quietly, in any setting, and for extended periods of time. The Massachusetts General Hospital's Biomotion Laboratory data were used to assess and validate the calibrated sensor outputs. The GaitShoe has proven to be quite effective at detecting heel-strike and toe-off, as well as, among other things, determining foot orientation and position.

5. (Berengueres, Fritschi, 2014) A smart pressure-sensitive insole that reminds you to walk correctly: An orthotic-less treatment for over pronation. We outfitted an insole with a force sensor that detects overpronation in real time. When this type of behaviour is detected, we notify the user so that they can correct their posture using their own muscles. Over a two-week period, the effectiveness of this novel method of correcting overpronation posture is evaluated. Using vibrotactile feedback during the first week reduces overpronation by 30% to 50%. The natural advantages of the proposed method over the use of passive orthotics are also discussed.
6. (Davia-Aracil, 2016) A new methodological approach for shoe sole design and validation. Due to their organically shaped but technically precise nature and manufacturing constraints, shoe soles are extremely complex to design and manufacture. As a result, increased design process flexibility provided by the use of specific CAD methodologies and techniques is required to facilitate the work of expert designers and allow for the effective construction of the three-dimensional elements comprising the entire structure. Recent advancements in additive manufacturing systems have broadened the scope of shoe sole design. These systems can be used to create the final mould as well as to incorporate dynamic elements that are especially important in sports footwear. We present a new methodology for designing and validating shoe soles in this article. The methodology aids designers in the design concept process as well as the design transfer to manufacturing. The model takes a structural as well as a functional approach. To that end, a set of specific tools for quantifying design quality has been developed. For example, the model calculates the coefficient of friction or slip resistance required to meet international safety footwear standards.

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## Research Gap

We think there is definitely a gap in the market for a product like this. This product is targeting three huge markets at once. Our product fits in tech, fashion and sports industries. Adding to the fact that we are looking to collaborate with different brands, we think our product can fit in a broader market and not just a niche product. Our biggest asset is the fact that our product is something very new and fresh. Let's be real, when was the last time we saw any real innovation in shoe soles. We are planning to make this one of a kind and getting into such a unique product means your competition is behind you. This is like apple with the iPhone. Smartphones were a thing when Apple launched the iPhone but they revolutionized smartphones, showing they don't have any limits and making the functionality easier for the consumer.

We are trying to do something similar as well. Shoe soles exist, yes, but it is no product to be excited about. We want to do something that makes people excited and that is where we add our technological aspect, allowing people to live a healthier lifestyle by helping them correct their posture. In terms of fashion we are planning to partner with different brands in order to have our soles in more fashion centric shoes and sneakers. We have many strategies as to how are we going to market the sole.

Let's be real have you ever seen advertisements for shoe soles? We are going to heavily market this product and make it something very commercial with aggressive marketing strategy. This is how companies like OnePlus have become so successful in the modern market. Our target is the old as well as the youthful audience. Social media marketing is going to be our key as we will put up ads on popular platforms like Twitter, Facebook, YouTube and Instagram. The app gives you a detailed information to where your posture goes wrong and helps you correct it. We are here to change the way people use their shoes.

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## Objectives of the study

- Posture walking shoes will help one live pain free.
- Our research provides knowledge that will help you eradicate posture issues.
- We believe that comfort is not a luxury, it is a necessity.
- We want to help you understand the importance of proper posture support.
- We want to have dedicated research teams, shoe stylists and foot doctors.
- We are planning to partner with brands to supply our soles and sell them.

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## Findings of the study

After a lot of pondering, Team 2 came up with the name SOLISTIC. It's a pun-ny approach to the word Solstice. SOL here refers to the shoe sole and *sistere* in Latin means to stand still. Standing still on our shoe sole will help our sensors start their first step towards your posture correction! And hence we present to you, our product – SOLISTIC.

During everyday locomotor movements, our feet come into direct contact with the ground, resulting in measurable plantar pressure. This has a plethora of information that might be incredibly beneficial to athletes or rehab patients, for example. Measuring and tracking the proper data can help athletes improve their performance, improve podiatric medical monitoring, prevent injuries, and identify disease risks early on. Our in-house created sensors, which are included in the shoe insole, monitor how pressure is distributed on the sole of the foot/shoe whether walking, jogging, or leaping. The data is subsequently delivered to a remote receiver for examination, thanks to powerful electronics (smartphone, watch or computer). You have the opportunity to personalise the data to fit your applications with our integrated software.

What are the advantages of using our smart footwear sensing solutions?

- Non-intrusive printed electronics that are thin and bendable
- Gait and posture measurement and analysis that is accurate and reliable
- Supporting rehabilitation, detection of lower limb disorders, specific footwear design, ulcer prevention for diabetics, enhanced balance and confidence for the elderly, and so on are some of the clinical applications
- Biomechanics, treatment, injury prevention, and training are all aspects of sports.
- Flexible, cost-effective, and customizable for individual applications, with a variety of integration options.
- 8 new-generation high-dynamic pressure cells in combination with sophisticated electronics and software.
- Uses top-of-the-line pressure sensing technology in conjunction with data from the Inertial Measurement Unit (MU).
- Performance monitoring, accurate gait analysis, and improved patient care
- The removable insole can be used for complete shoe integration or for removable insole applications.
- Synchronisation of data (between left and right foot and smart device)
- Personal data visualisation and real-time data presentation

When it comes to running, many people don't consider proper form or running terms, which can make it difficult to run longer distances without experiencing pain. Good form is crucial for pain-free long-distance running, as it can increase efficiency and reduce discomfort, allowing you to focus on your performance. However, teaching everyone the correct form has its limitations, and some runners may still experience hip and lower back pain after running for extended periods.

To address this issue, SOLISTIC has developed a solution in the form of insoles with embedded pressure and motion sensors that can be inserted into your running shoes. These insoles provide comfort and help improve your running form, reducing pain and discomfort. The SOLISTIC inserts consist of two pieces: the insoles that go into each shoe and a mount that runs out of the shoe, as well as two trackers that clip into the mounts. The trackers can be challenging to remove and snap onto the mounts, but their secure attachment is beneficial when running for long distances. The whole system is not too tethered, making it easy to move between different pairs of running shoes.

SOLISTIC's insoles can last through three pairs of running shoes or about a thousand miles, and they are IP65 water-resistant, making them suitable for use in the rain and through puddles. The battery lasts around five hours, making them suitable for ultra-runners, although they will require more frequent charging. Once the trackers are charged and mounted, they can be paired to your phone via the product's app or by pressing the button on each sensor. The insoles have 16 pressure sensors that send data to the tracker outside each shoe, which then sends it to your phone. This data includes foot pressure, strike tempo, and pronation, providing precise information about your running form. The app also shows additional data, including distance travelled, duration, pace, splits, elevation, calories, step length, and foot strike. The app offers advice on how to fix any issues and provides general information on improving your form.

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## Recommendations

The product design is based on an existing posture correction sensor used in chairs, which has been adapted to create a smart sole equipped with six flexible force sensors. The sensors are connected to an IoT node based on Arduino, which collects and processes data to detect incorrect running or jogging positions and notify users via a mobile application. The system is designed to help people pay more attention to their health by providing feedback on running or jogging posture and additional statistical data.

The team reviewed existing systems for sitting posture monitoring and categorized them into three main categories based on how they obtain information: computer image processing, wearable clothing with sensors, and measuring the load distribution on a substrate. They conducted research on patient monitoring based on image processing using a Microsoft Kinect camera, and on monitoring athletes using reflective markers and a video system to monitor posture correctness.

The team also examined various sensor technologies and pattern recognition algorithms for analyzing sensor data, such as the Census sensory sole, which uses a custom module for motion detection with accelerometers, gyroscopes, and magnetometers, and achieved an 80% success rate in running position classification using a combination of Boosting, Neural Networks, and Random Forest algorithms.

One of the crucial considerations for the proposed smart sole was hardware uptime without the need for recharging. During testing, an external power bank with a capacity of 4000 mAh was used, providing up to 48 hours of active measurement. The team also developed simple rules for detecting correct running posture with minimal computation power requirements.

The mobile application provides notifications on sitting posture correctness and other detailed information, and the system is designed to be easy to implement and use. The team used three threshold values to evaluate running posture correctness and defined three groups: green, orange, and red. The system also calculates the time of a run without a break and alerts users in case of long-term continuous running. Overall, the proposed system offers a simple and effective solution for monitoring running and jogging posture and promoting better health and well-being.

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## Conclusion

We aim to help individuals unlock their full potential in running by leveraging science and technology. SOLISTIC's approach combines these two fields to equip runners with a deeper understanding of what their bodies can truly achieve. Our goal is to empower runners of all levels, whether they're looking to compete in races, enjoy nature, or improve their overall health. Through personalized data and tailored insights, our platform helps runners achieve their goals safely and efficiently, regardless of their experience level. SOLISTIC is a Bangalore-based startup focused on revolutionizing the health and fitness industry with its line of wearables. We believe in hiring talented individuals who, like the athletes we serve, are constantly pushing themselves to reach new heights. Our culture is built on empowering our team members to be their best selves, with a diverse team that thrives on passion and customer-centricity. At SOLISTIC, we understand that employee engagement comes from working on exciting projects and taking calculated risks. Our fluid environment encourages growth and learning while having fun.

Shoe insoles have the potential to encourage safe walking and serve as an effective intervention. Biomechanical gait analysis can monitor the effects of insoles on walking performance. Insole modifications can improve foot pressure distribution, absorb shock, and reduce proprioceptive reaction time while also supporting adaptive ankle angles. It's important to test the long-term effects of shoe insoles to confirm their safety and effectiveness. Integrating wearable sensors into insoles will be crucial for future real-time gait measurement. With the help of online data management, detailed gait analysis will be accessible to everyone, allowing for better monitoring of everyday gait activities.

## SOLISTIC – THE – HOLISTIC SOLE.

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