Stress Distribution of Foot during Standing Stance

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Concept

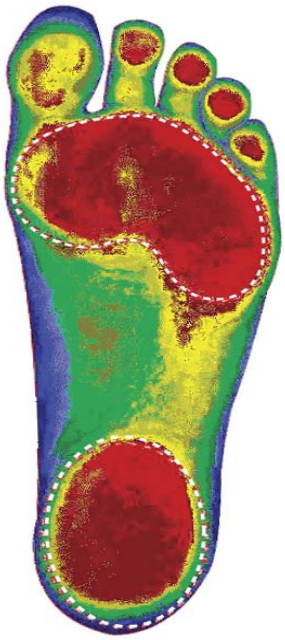
For any force exerted on a surface with an area resisting the force, stress is distributed on the surface.

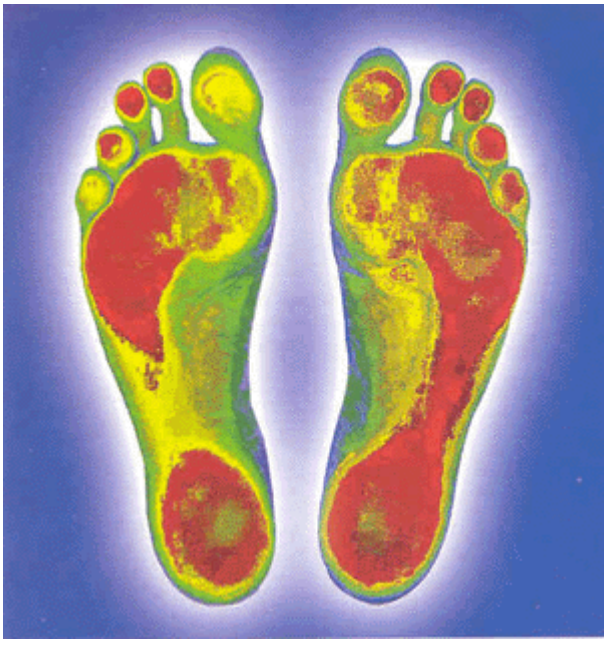
Stress = Force/Area

Therefore as the force is fixed, the area of the surface will determined the stress distributed to the area. We could say the stress is inversely proportional to the surface area.

Stress α 1/Area

I will be using a practical example where the weight of a human body is distributed by the surface of the foot on the ground while in standing stance. It will show us more of how will the force be distributed with different foot surface.



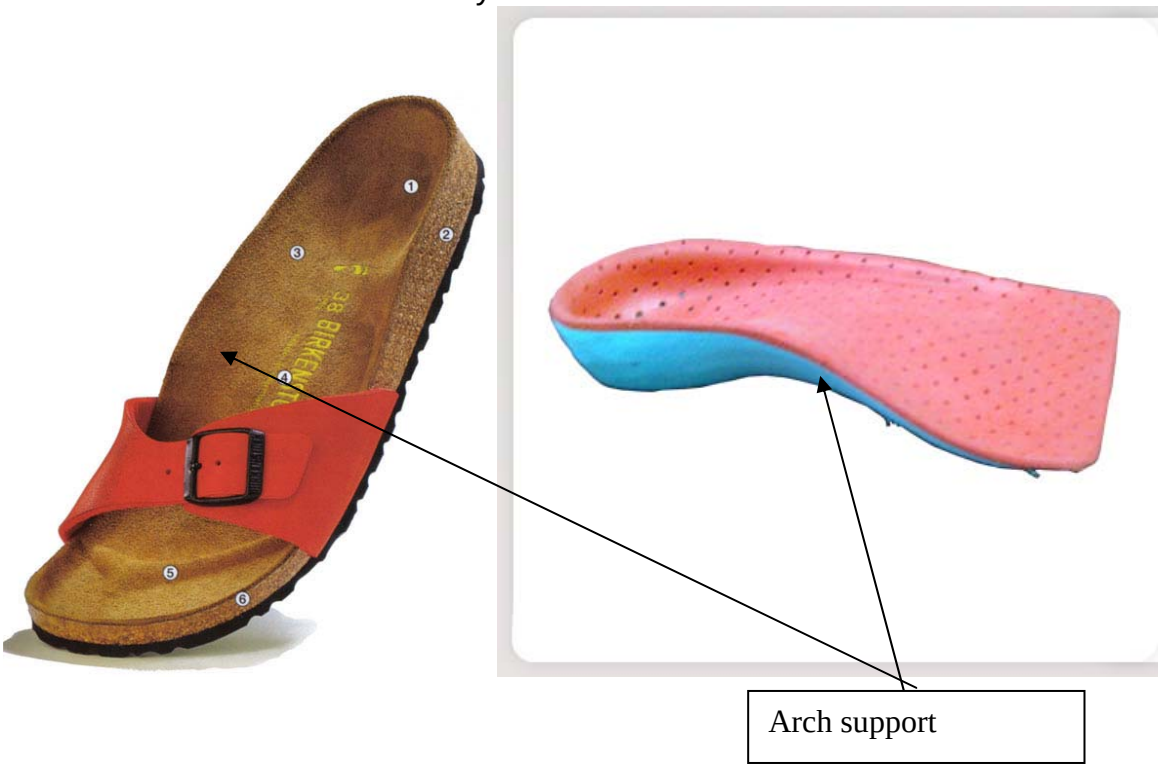


These pictures show the foot surface where test have been done in order to check the weight distribution on to our foot. The red section shows that the area with highest force exerted and the green section are the least force exerted by the human. This shows that different parts of our foot surface will have different amount of force exerted onto the floor while in standing stance.

This has been a problem for proper weight distribution because it will damage the bones of our foot in the long term. Such problems usually occur when we are old and will have difficulties to stand properly. Many researches have been undergone in order

to reduce the red sections which are to make the area surface bigger and reduce the force exerted on specific location.

A good solution is using a shoe or slipper with surface which is specially designed for each specific foot. Usually the section of foot which is needed to shift the stress to is the arch at the middle of our foot. Therefore, a lot of designs have been made to be suitable for us to wear comfortably.



When without the shoe insole, (with force exerted, F and area, A)
Stress = F/ 0.5A (we assume the area is approximately half of the area of the foot)
= 2 F/ A

When with shoe insole, (same force and area as the above)
Stress = F/ A (we assume the foot surface is the whole surface area)

By this theory, we could see that the stress created without the shoe insole will be bigger than the stress created with shoe insole.

As a conclusion, it is better to start considering the height of your arch support and have a shoe insole for a better stress shift on our foot.

References

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