

The effects of pressure redistribution of an innovative cradle-shaped turning mattress, compared to manual repositioning of bed-ridden patients

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Aim

The aim of this work was to investigate the pressure distribution in an innovative mattress-system that is automatically shaped as a cradle before it slowly starts the turning process.

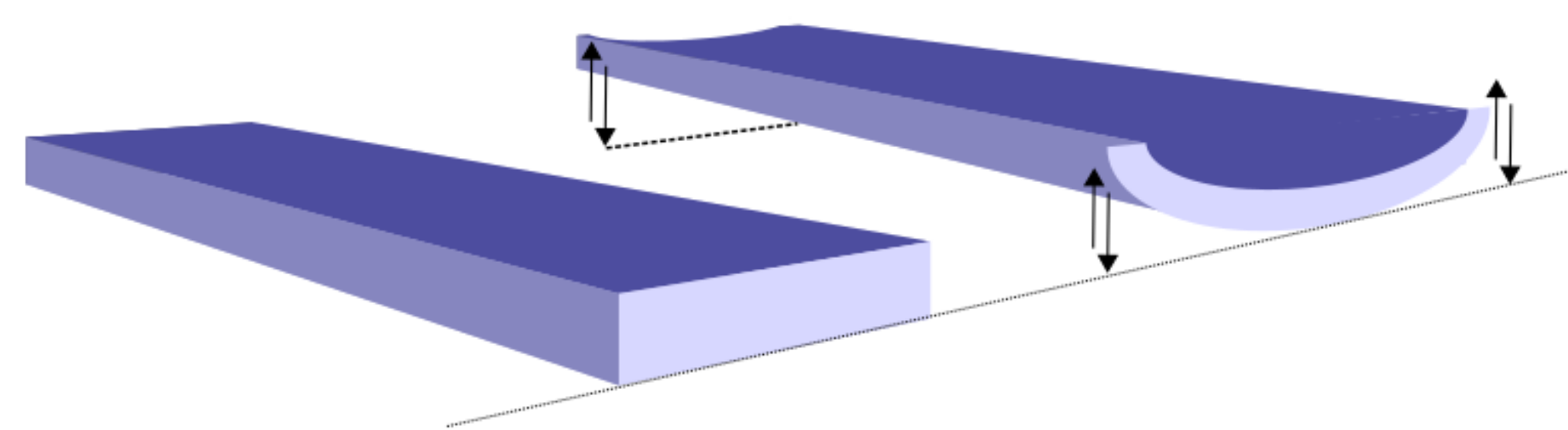


Figure 1. On the left side is an illustration of an ordinary mattress, where the surface is flat. On the right side is an illustration of the cradle-shaped mattress.

Findings

Pressure or pressure in combination with shear of the skin and underlying tissues over bony prominences is seen as the main cause of pressure ulcers (EPUAP). The amount of pressure/shear over time is a major factor for cell deformation and cell death. To reduce the time tissues are deformed, repositioning is paramount. A 30° side-lying position is recommended according to the EPUAP guidelines. However, repositioning is seen as a challenge for the patient, i.e. as a disturbance, strongly affecting the sleep pattern and thus their Quality of Life. For caregivers, it is also challenging to reposition the patient in a stable, comfortable and secure 30° side-lying position. When comparing pressure images of the test person lying in a manual positioned 30° position with cushion support, with images while being rotated by the automated system, we clearly observed better readings in the cradle system than in the manual positioned situation.

Figure 4 shows how images are generated from the pressure sensor mat, and further analyzed. In Figure 5, the results from the different positions are shown. The colors indicate pressure-levels, given in mmHg.

We clearly see that the pressure increases with time. The pressure distribution remains more or less the same. This is different for the automated system, where the rotation leads to distribution of pressure and allows for microcirculation to occur.

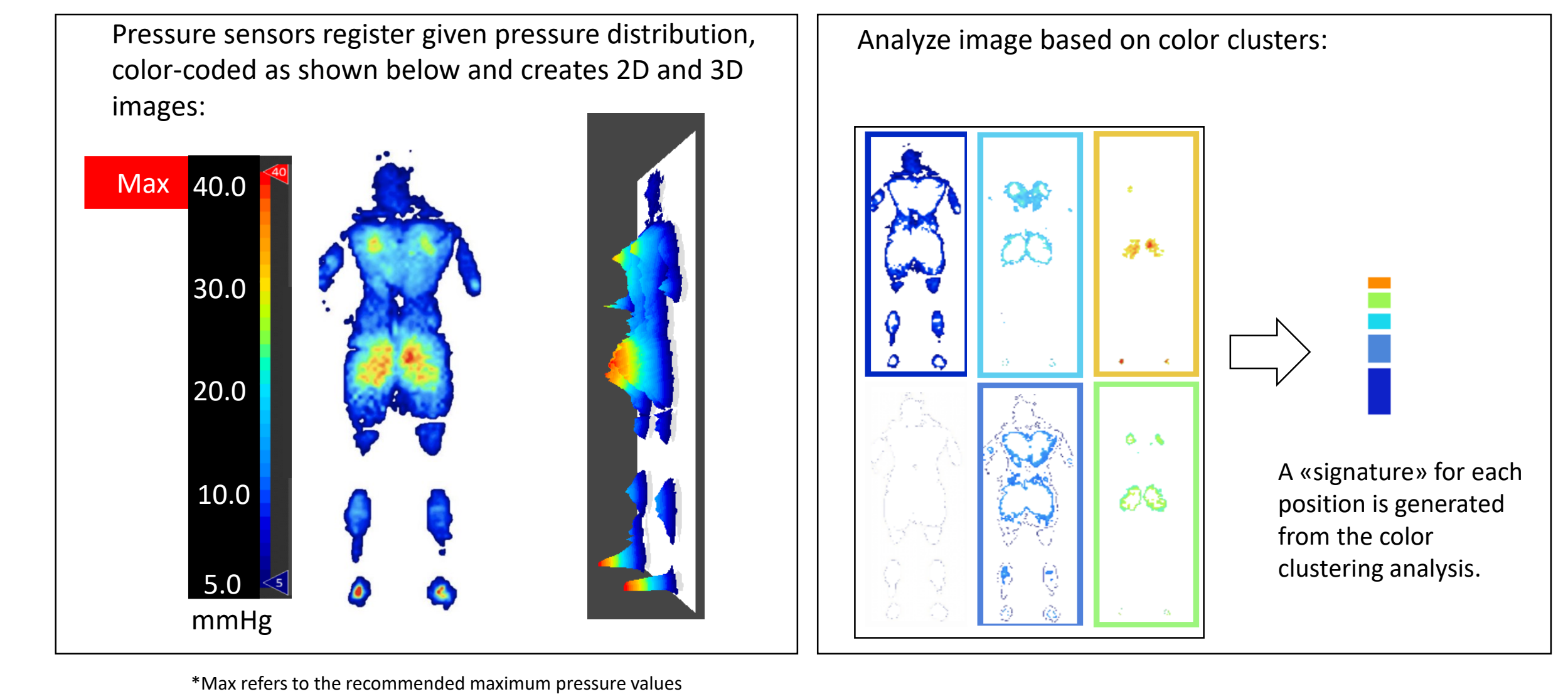


Figure 4. Pressure sensors creates an image of the given pressure distribution. The image is represented in 2D and 3D, and is measured in mmHg. The maximum pressure is related to recommendations. The images was analysed by clustering of the colors.

Method

A healthy volunteer (male, 83 kg) was recruited as test person.

The mattress technology is installed as shown in Figure 2, with a pressure sensor mat (XSensor Technology Corporation) on top. The test person was manually repositioned in the positions demonstrated in Figure 3 (supine, 90° lying position and 30° lying position). The innovative mattress-system is shown to the right.



Figure 2. The test set-up consisted of an ordinary rubber foam mattress that is placed on top of the innovative mattress system. A pressure imaging sensor mat was placed on top of the rubber foam mattress.

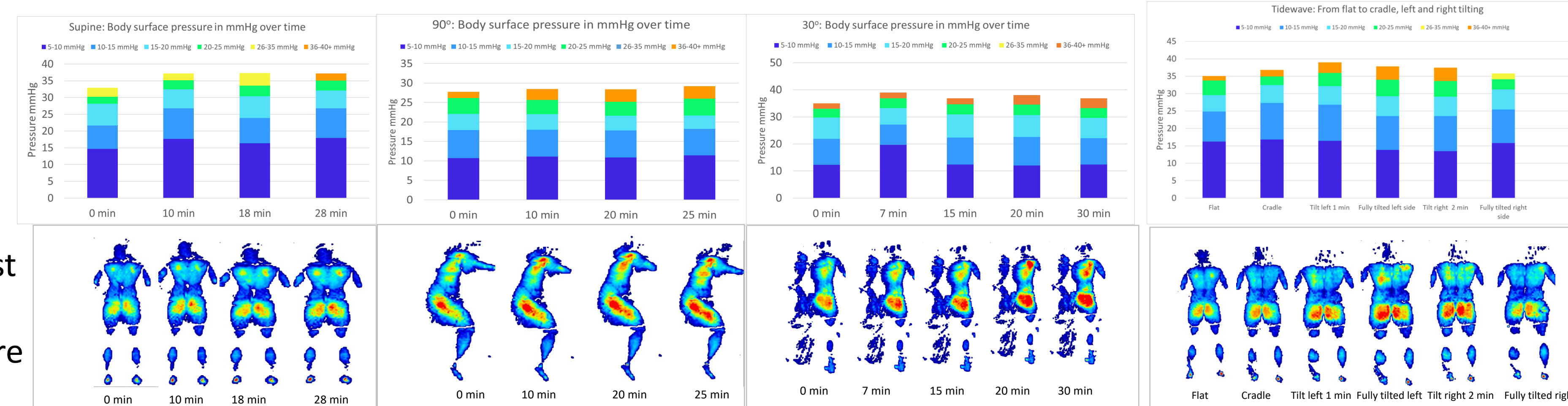


Figure 5. Results from the different tests. Notice that the pressure increases with time, indicated by red color in the pictures. To the right is the innovative mattress system, and it clearly shows that the micromovements caused by the turning process, aids in improved pressure distribution.

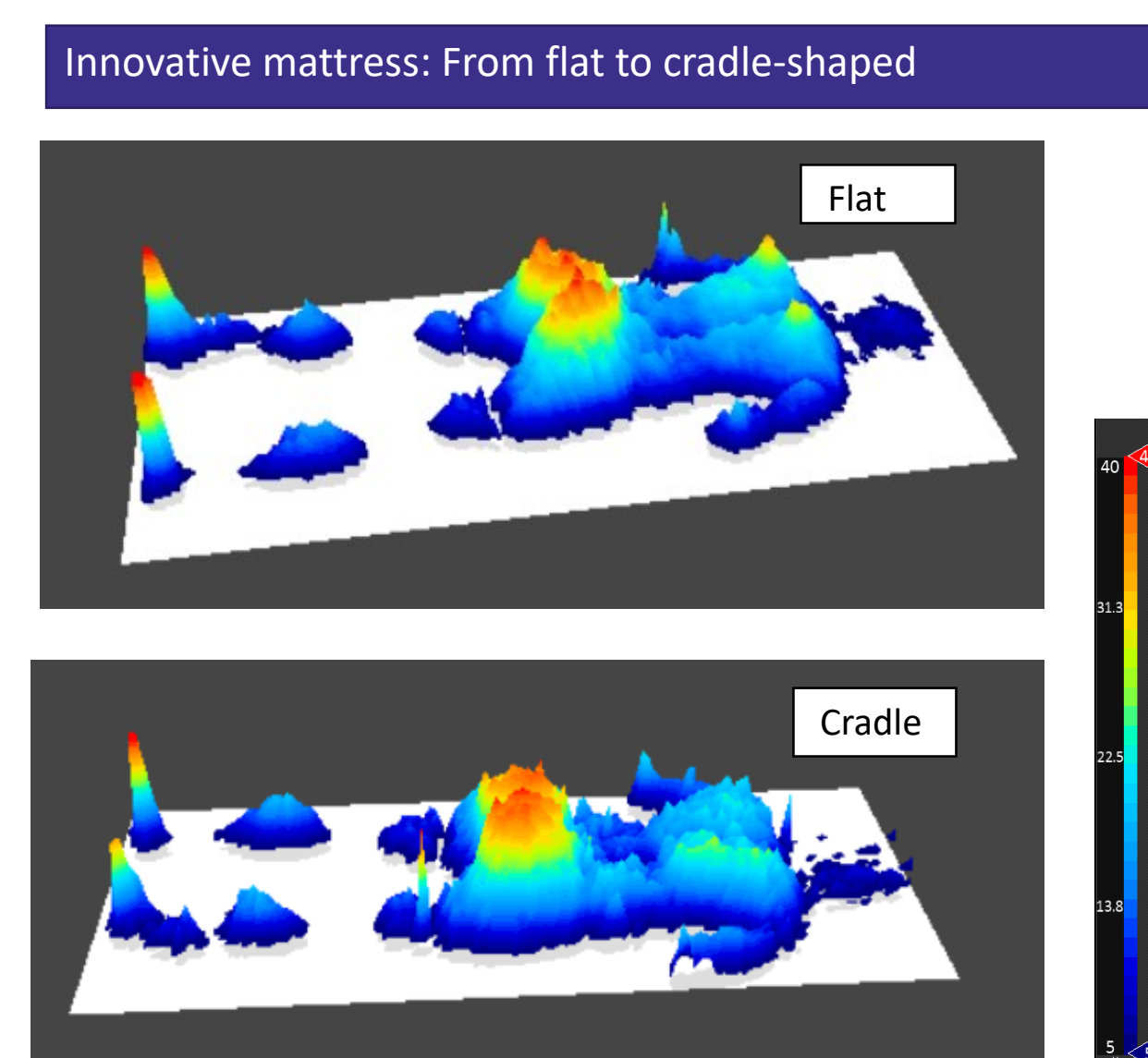


Figure 6. A 3D representation of the pressure distribution when the mattress goes from flat to cradle-shaped form.

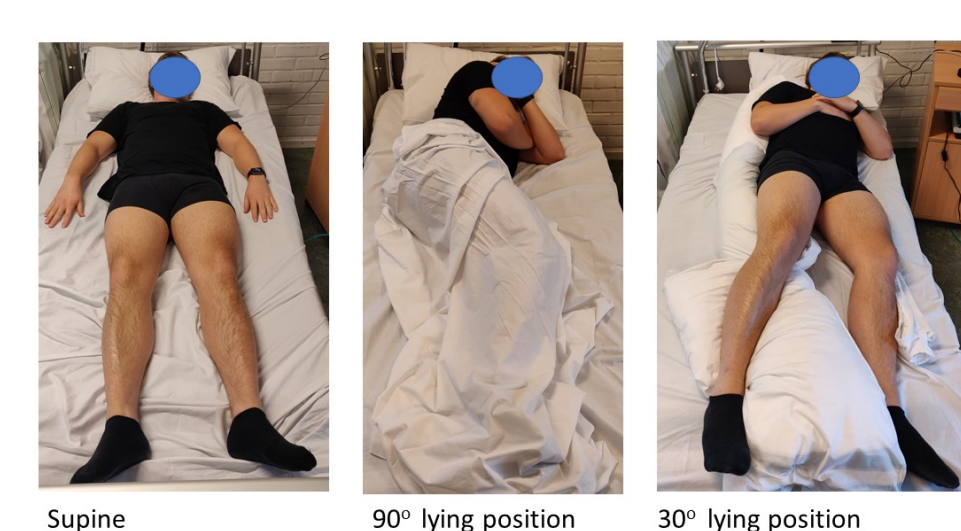


Figure 3. Test person in different lying positions.



Conclusions:

- The **surface area increased** with app. 9% when the testperson was lying on the innovative mattress system compared to supine position on a flat surface.
- The pressure levels did not decrease significantly when the test person was lying on the innovative mattress compared to manual repositioning.
- Importantly, the **pressure distribution changed significantly** when the test person was lying on the innovative mattress system compared to manual repositioning. Pressure relief on local areas by body micromovements can aid in management and relief of pressure ulcers.
- The test person felt comfortable when lying on the Tidewave mattress, as the cradle-shape surrounds the person in a comforting manner.