LINET

REPORT ON TESTING THE RADIOLUCENCE OF MATTRESSES WITH THE USE OF X-RAY SLEEVE OR X-RAY HOLDER



Introduction

There was performed X-ray testing of the translucency of different mattresses with different X-raying possibilities such as an X-ray holder in hospital beds or stretchers and an X-ray sleeve in mattress covers.

Date: 18.4.2024 and 18.12.2024

Place: Hospital in Slany, Czech Republic

Report is made by: Lucie Řehořová

Digital x-ray detector : Pixium 3543 EZ

Digital radiograph: Agfa DR600

Exposition setup: 125 kVp, 2 mAs

TESTED MATTRESSES

- OptiCare X with X-ray sleeve
- Virtuoso PRO with X-ray sleeve
- Symbioso
- HybriMatt 200 with X-ray sleeve
- EffectaCare 20
- Sprint 200 with X-ray sleeve
- Sprint 100
- Air2Care 8
- ViskoMatt 30
- ViskoMatt 10

BEDS AND STRETCHERS WITH X-RAY HOLDER USED FOR TESTING

- Hospital beds: MultiCare X, MultiCare, Eleganza 5, Eleganza 4, and Essenza 300
- Hospital stretchers: Sprint 100

Method

To test mattresses with **X-ray holders**, a radiologist placed a digital x-ray detector into the X-ray holder under the bed platform and performed X-ray imaging at the location corresponding to the backrest, where the patient's trunk would typically be positioned, as shown in Image 1. The X-ray images were repeated with different mattresses to evaluate the influence of the mattresses on the overall quality of the X-ray images captured using the X-ray holder.

To test the **X-ray sleeve**, X-ray images were taken with the digital x-ray detector placed inside the X-ray sleeve to assess the effect of cover fabrics on the resulting images. Image 2 shows placing the digital x-ray detector into the X-ray sleeve of the OptiCare X.

During the testing process, not all pressure air mattresses were inflated to maximum pressure, because there is no general recommendation about X-raying through a pressure air mattress.

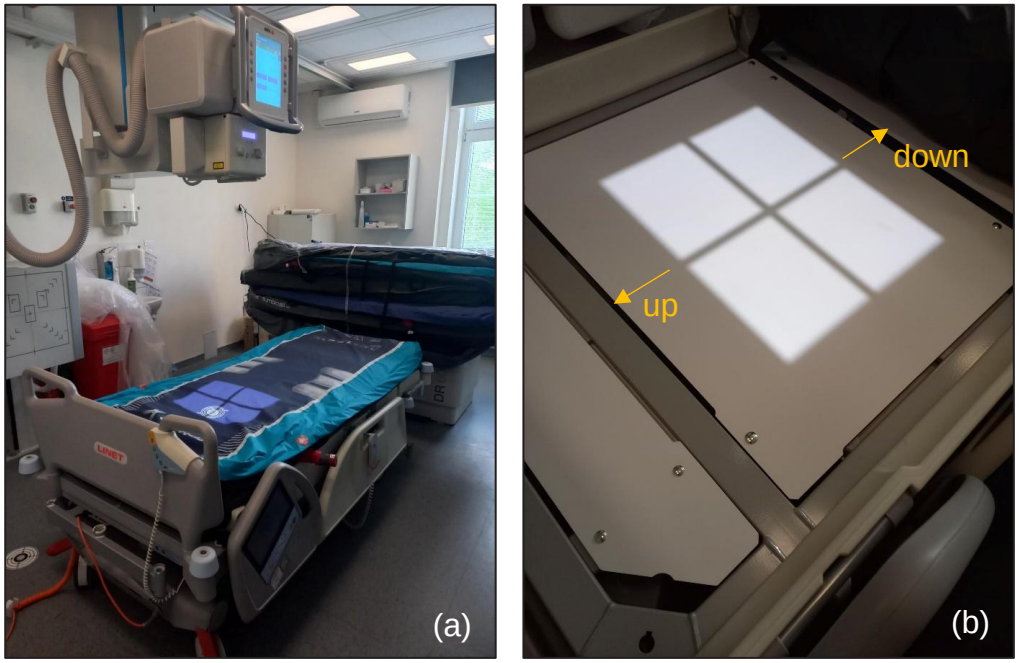


Image 1 (a) taking an X-ray image in the X-ray holder of the Multicare X under bed platform (b) the digital x-ray detector can be moved up and down in the X-ray holder based on patient position.

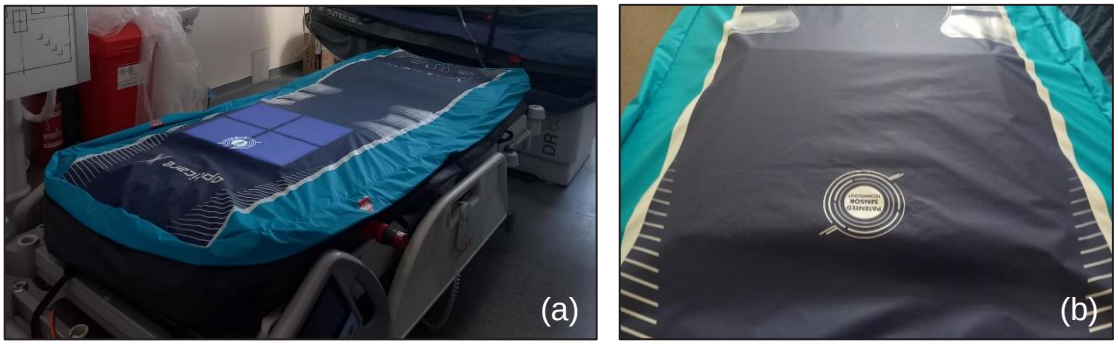


Image 2 (a) taking an X-ray image in the X-ray sleeve of the OptiCare X mattress (b) detail of the digital x-ray detector visible under the cover.

RESULTS

The results are displayed for each mattress with a combination of bed or stretcher, featuring an X-ray image with the digital x-ray detector in the X-ray holder and/or in the X-ray sleeve.

Neither bed with the X-ray holder demonstrated any artifacts, because of the translucent HPL board backrest.

OptiCare X mattress

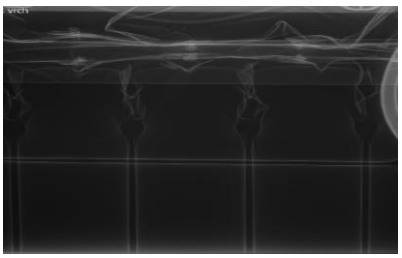
(applicable for the OptiCare)



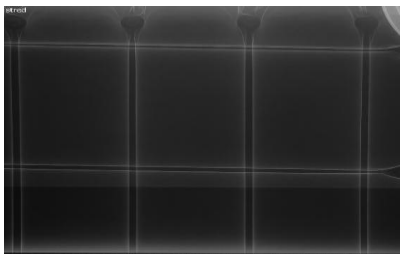
MATTRESS DESIGN:

The OptiCare X mattress is designed with two layers of pressure air cells beneath the pelvis and trunk areas. The cells in the bottom layer are arranged horizontally, while those in the upper layer are arranged vertically.

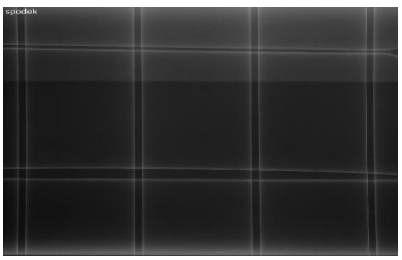
An optional X-ray sleeve is positioned above the cells, directly beneath the cover, with separate zip access available from both sides of the mattress.



OptiCare X mattress: digital x-ray detector in the X-ray holder – up position



OptiCare X mattress: digital x-ray detector in the X-ray holder – centre position



OptiCare X mattress: digital x-ray detector in the X-ray holder – bottom position



OptiCare X mattress: digital x-ray detector in the X-ray sleeve

SUMMARY

An X-ray image taken through the OptiCare X with the digital x-ray detector placed in the X-ray holder reveals the lines of the longitudinal cells in the bottom, and the horizontal cells in the upper layer. If the holder is positioned closer to the head end of the bed, the tubing may also become visible. The mattress must be kept fully inflated to ensure the visibility of straight lines, and the holder should be positioned lower to avoid interference from the tubing.

An X-ray image taken in the X-ray sleeve shows no artifacts.

Virtuoso PRO mattress

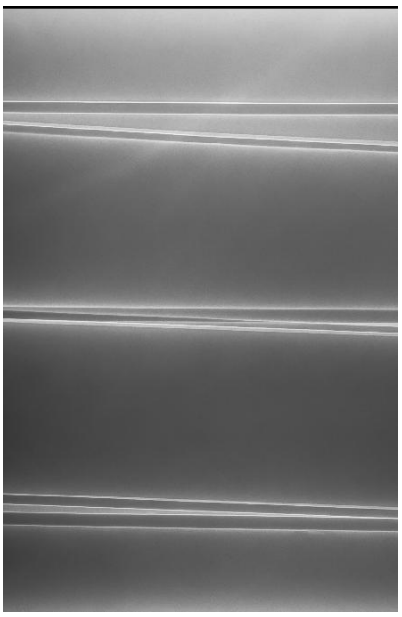
(applicable for the Virtuoso 300, 200, and 100 models)



MATTRESS DESIGN:

The Virtuoso PRO mattress is constructed with two layers of air cells, both arranged horizontally.

An optional X-ray sleeve is positioned in the backrest area. The X-ray sleeve is located above the pressure air cells, directly beneath the cover, and can be accessed from both sides of the mattress via separate zip openings.



Virtuoso PRO mattress:
digital x-ray detector in the X-ray holder



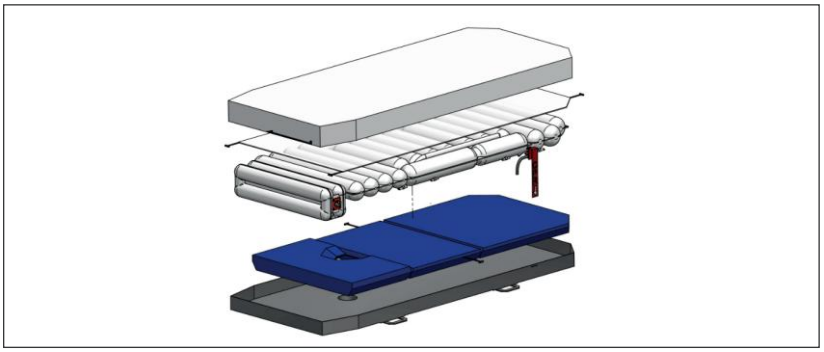
Virtuoso PRO mattress:
digital x-ray detector in the X-ray sleeve

SUMMARY

An X-ray examination through the Virtuoso PRO mattress when the digital x-ray detector is located in the X-ray holder reveals only the horizontal cells, which are present in both layers and overlap. To ensure the visibility of straight cell lines for proper identification in the X-ray image, it is recommended to keep the mattress fully inflated.

An X-ray image taken from the X-ray sleeve displays no artifacts.

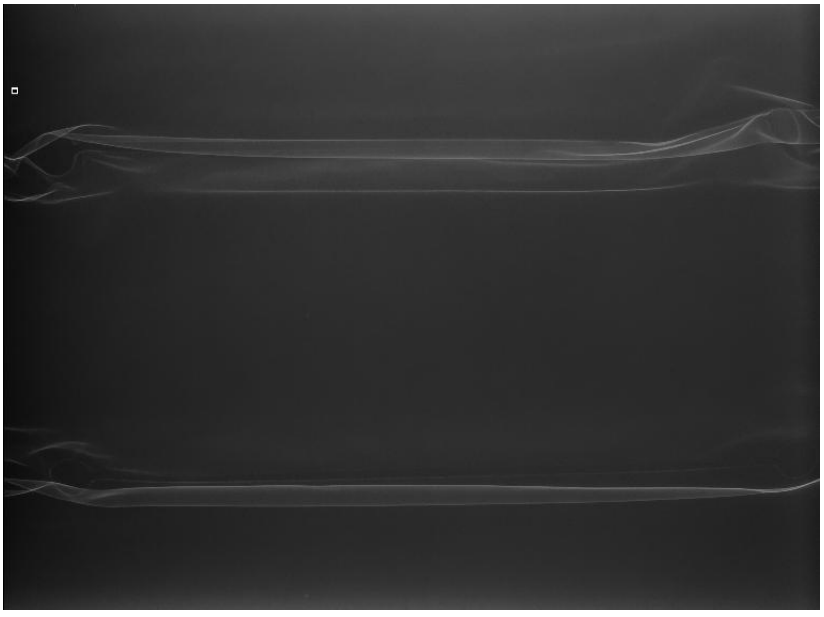
Symbioso mattress



MATTRESS DESIGN:

The Symbioso mattress features a top layer of pressure air cells, and a bottom layer made of polyurethane foam. The air cells are arranged horizontally.

The mattress does not offer an optional X-ray sleeve.



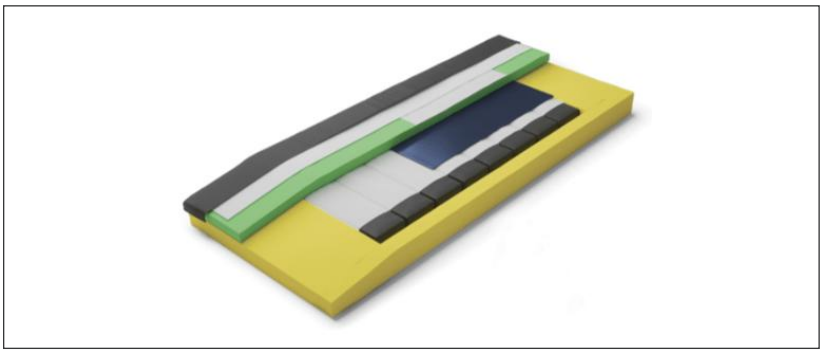
Symbioso mattress:
digital x-ray detector in the X-ray holder

SUMMARY

X-raying through the Symbioso mattress with the digital x-ray detector placed in the X-ray holder reveals only a single layer of horizontal cells. However, the visibility of the cells is diminished because the mattress is not fully inflated, making it challenging to clearly interpret the cell edges. This reduction in clarity can lead to confusion, as the edges of the cells may be mistaken for patient tissues in the X-ray image.

HybriMatt 200 mattress

(applicable for the HybriMatt 100 and HybriMatt 100 IN)

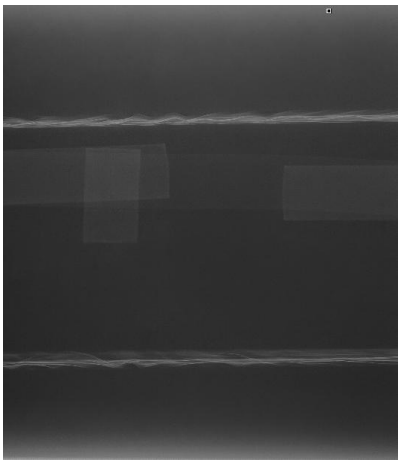


MATTRESS DESIGN:

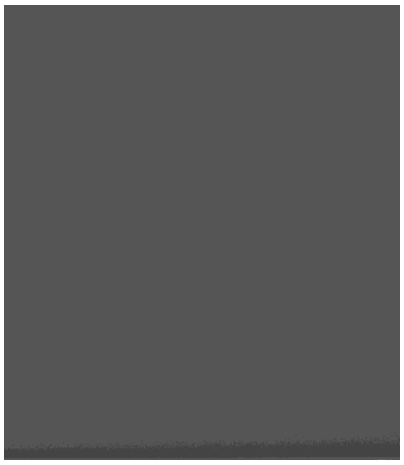
The mattress is a hybrid design that combines foam and air cells. The top layer is made of viscoelastic foam with a fire sock, while the bottom layer consists of air cells with a polyurethane foam core.

In the case of the HybriMatt 200, the mattress may also be equipped with evacuation straps which can be folded underneath the mattress.

An optional X-ray sleeve is placed between the viscoelastic foam layer and the air cells in the trunk area. The X-ray sleeve can be accessed from both sides of the mattress through separate zip openings.



HybriMatt 200 mattress:
digital x-ray detector in the X-ray holder



HybriMatt 200 mattress:
digital x-ray detector in the X-ray sleeve

SUMMARY

X-raying through the HybriMatt mattress with the digital x-ray detector placed in the X-ray holder demonstrates the visibility of the horizontal foam cells and the folded evacuation straps beneath the mattress (which are available only in the HybriMatt 200). The mattress cells do not need to be inflated to maximum pressure like the cells with a foam core.

X-raying through the viscoelastic foam with the digital x-ray detector located in the X-ray sleeve does not display any artifacts caused by the fabric or foam.

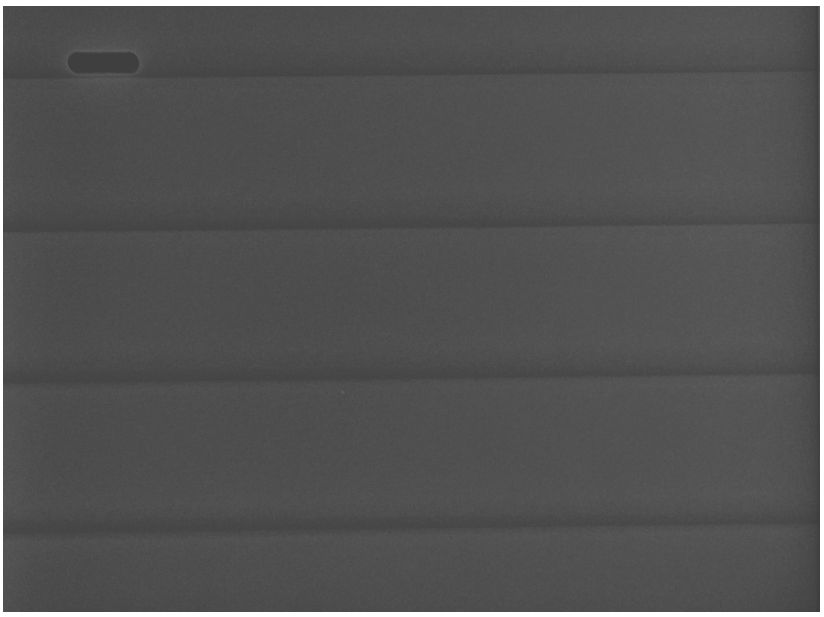
EffectaCare 20 mattress



MATTRESS DESIGN:

The mattress is constructed from a single block of polyurethane foam. It features horizontal cuts on the top and bottom layers.

The mattress does not include an optional X-ray sleeve.



EffectaCare 20 mattress:
digital x-ray detector in the X-ray holder

SUMMARY

X-raying through the mattress with the digital x-ray detector placed in the X-ray holder reveals the horizontal cuts in the foam, which appear as dark straight lines in the X-ray image.

Sprint 200/400 mattress

(applicable for all Sprint 200/400 mattresses: the Standard, Comfort, Advanced, and Reactive)



MATTRESS DESIGN:

Mattress is equipped with an X-ray sleeve, which is located under the mattress cover. The X-ray sleeve is placed from the head end towards the knees. The X-ray sleeve can be accessed from both sides of mattress.

The stretcher does not offer an X-ray holder.



Sprint 200/400:
digital x-ray detector in the X-ray sleeve

SUMMARY

X-raying with the digital x-ray detector placed in the X-ray sleeve does not display any artifacts from the cover or the X-ray sleeve fabric.

Sprint mattress with Sprint 100 stretcher



MATTRESS DESIGN:

The mattress is made of a single thin layer of polyurethane foam which does not have an optional X-ray sleeve.

There also exists a version of the Sprint 100 with the option to perform a fluoroscopy with a C-arm, which is covered in a separate report.



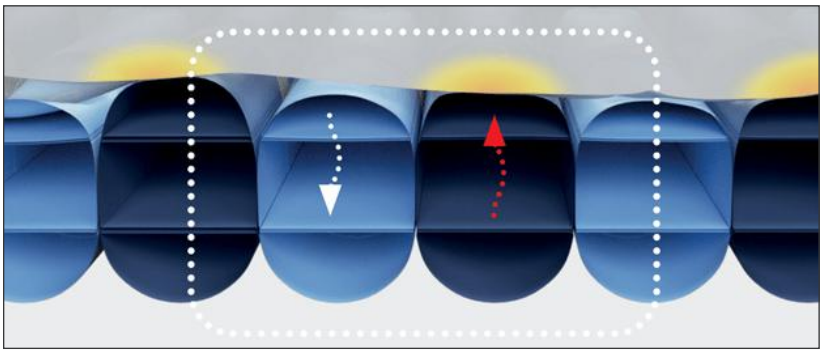
Sprint mattress:
digital x-ray detector in the X-ray holder

SUMMARY

X-raying through the Sprint mattress with the digital x-ray detector placed in the X-ray holder demonstrates a clear image with no artifacts caused by the bed or the mattress itself.

Air2Care 8

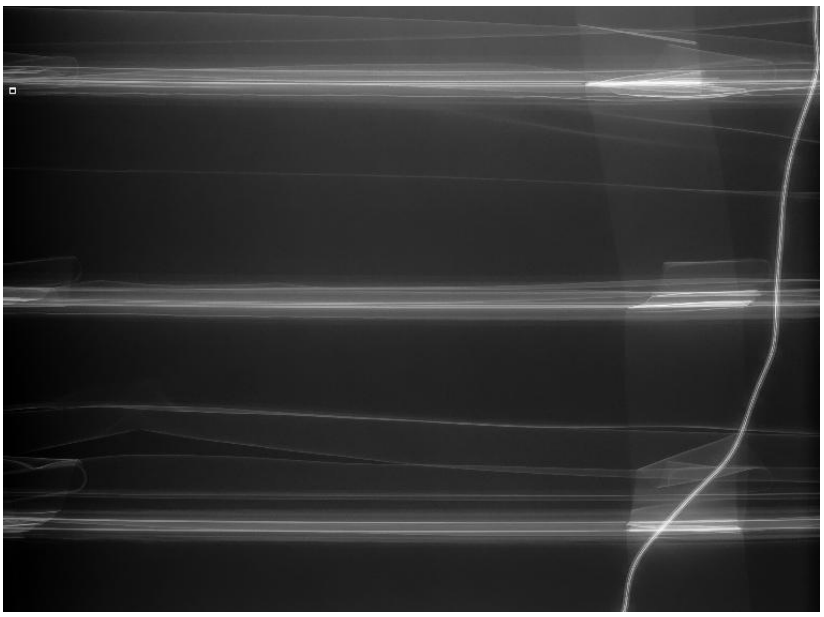
(applicable for the Air2Care 6, Air2Care 5, Air2Care 6 IN, and Air2Care 8 IN)



MATTRESS DESIGN:

The pressure air mattress consists of a single layer of air cells divided into three chambers.

The mattress does not include an optional X-ray sleeve.



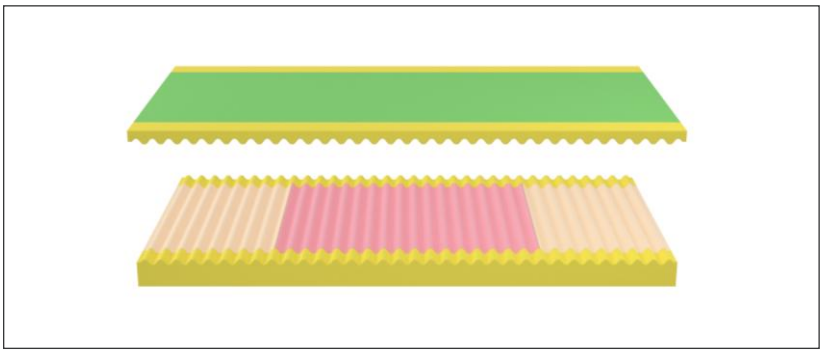
Air2Care 8 mattress:
digital x-ray detector in the X-ray holder of the Multicare X

SUMMARY

X-raying through the Air2Care 8 mattress reveals a single layer of horizontal cells secured by plastic bands. These bands are located on both sides of the mattress, but only one side is visible in the image. Because the mattress was not fully inflated, small distortions are visible. If the cells were inflated to maximum pressure, the straight lines of the cells would be easier to identify. The image also shows the Fowler boost digital x-ray detector cable, which lies beneath the cells.

ViskoMatt 30 mattress

(applicable for the ViskoMatt 50 and ViskoMatt 30B)



MATTRESS DESIGN:

The mattress is constructed with two layers of foam. The bottom layer consists of cold foam and polyurethane foam, while the top layer is made of viscoelastic foam. The mattress is enclosed in a fire sock and a protective cover.

Mattress does not have an optional X-ray sleeve in the cover.



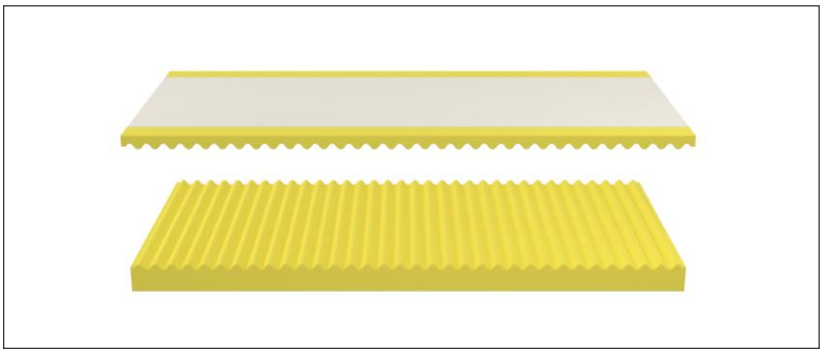
ViskoMatt 30:
digital x-ray detector in the X-ray holder

SUMMARY

X-raying through the mattress with the digital x-ray detector placed in the X-ray holder produces a clear image due to the homogeneous foam material. The mattress construction does not create artifacts. The only visible line in the image is a straight line resulting from the glue used to join the two foam layers in the bottom layer.

ViskoMatt 10 mattress

(applicable for the MediMatt 30 and ViskoMatt 10B)



MATTRESS DESIGN:

The mattress is constructed with two layers of foam. The bottom layer consists of polyurethane foam, while the top layer is made of viscoelastic foam. The mattress is enclosed in a fire sock and a protective cover.

Mattress does not have an optional X-ray sleeve in the cover.



ViskoMatt 10:
digital x-ray detector in the X-ray holder

SUMMARY

X-raying through the mattress with the digital x-ray detector placed in the X-ray holder produces a clear image due to the homogeneous foam material. The mattress construction does not create artifacts.

Conclusion

The **X-ray sleeve** in all mattresses produced no artifacts due to its position beneath the mattress cover. For X-ray sleeve usage, the patient's condition should be considered, as the patient needs to be repositioned when inserting the X-ray digital x-ray detector into the sleeve.

When an X-ray is taken using the bed's **X-ray holder,** the chosen mattress (passive, hybrid, or pressure air) could impact the resulting image:

- **Foam mattresses** produced no or minimal artifacts. Any visible artifacts may be caused by cuts in the top or bottom layer of the mattress, or by glue. These artifacts are easy to interpret because they are geometric and low contrast.
- **A hybrid mattress**, which is a combination of foam and alternating air cells, shows visible cell lines when X-rayed through the mattress. The cell lines are straight and low contrast, as they are formed by a rectangular foam core. If the X-ray images are required to be free of artifacts, the HybriMatt 200 mattress is equipped with an optional X-ray sleeve.
- When **pressure air mattresses** are X-rayed, when the X-ray digital x-ray detector is placed in the holder, the air-filled cells are always visible due to the higher contrast between the air and mattress materials. Air is completely radiolucent and is black in an X-ray image. The mattress must always be fully inflated to create geometrically consistent artifacts that are easy to identify. During testing, mattresses that were not fully inflated produced irregular artifacts which could affect the interpretation of the patient's X-ray image. If the X-ray images are required to be free of artifacts, the Virtuoso and OptiCare (X) mattresses can be equipped with an X-ray sleeve.

Disclaimer

Taking X-rays through pressure air mattresses with the X-ray digital x-ray detector in an X-ray holder

Please note that image quality may be affected by artifacts and is not intended for diagnostic purposes. The intended use is to support the confirmation of line and tube placement and complications that may occur following these procedures.

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