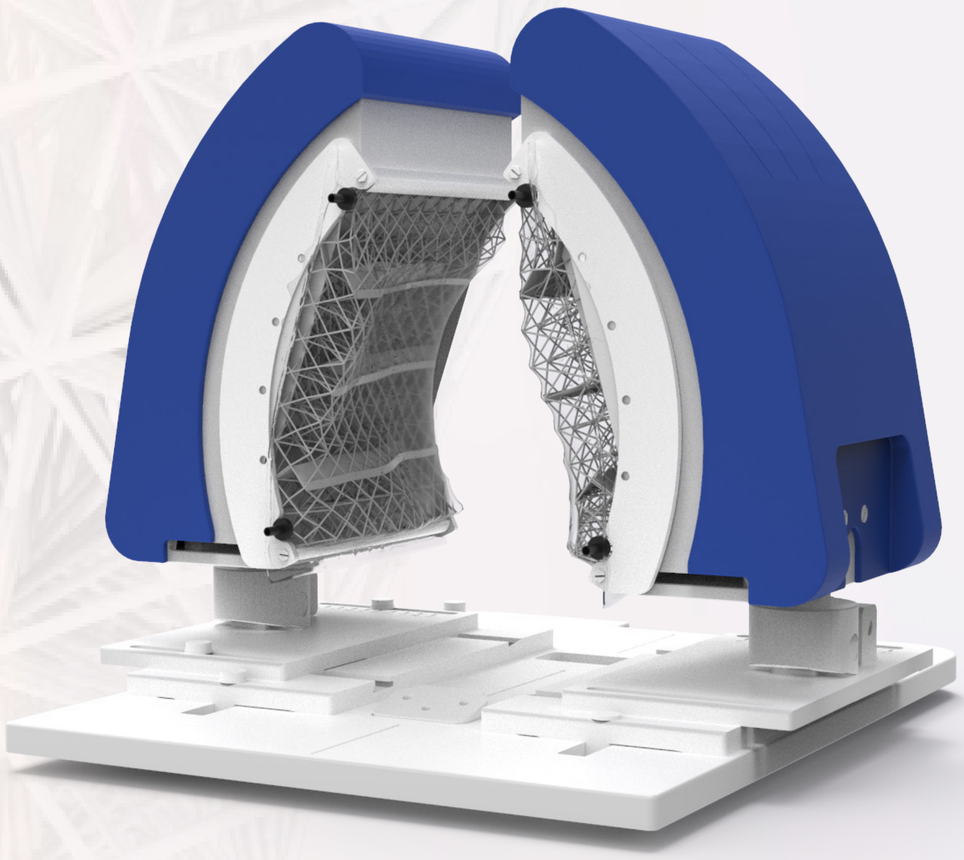


ERGONOMIC WATER BOLUS DESIGN

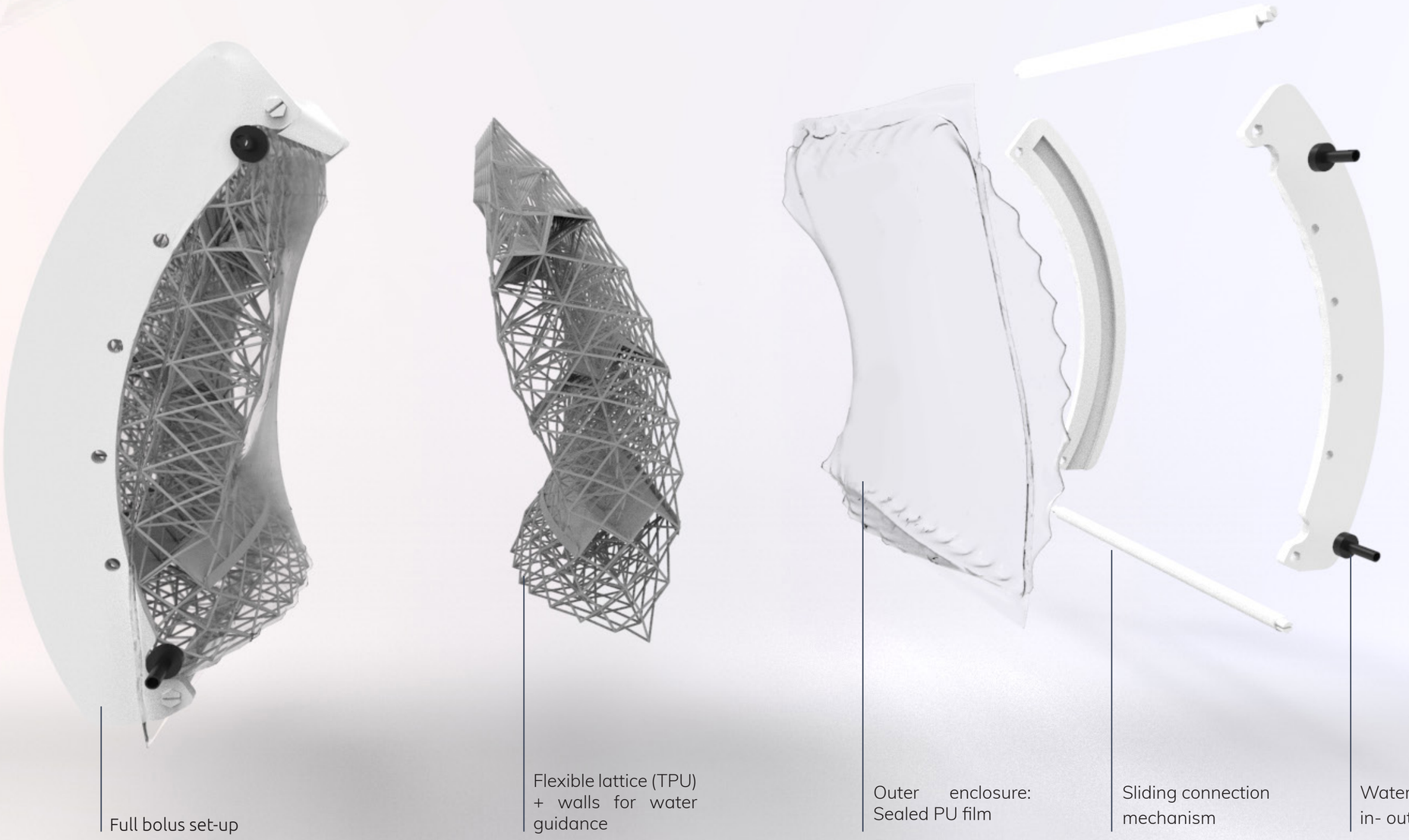
For Hyperthermia Treatment of Head and Neck Cancer Patients

Hyperthermia (HT) is a cancer treatment that is generally used in combination with chemotherapy or radiotherapy. During this therapy, electromagnetic energy is used to elevate the temperature of a tumour to 40–44 °C for 60–90 minutes. This process makes the tumorous cells more sensitive to radiation and chemotherapy.

A water bolus needs to be placed between the EM wave applicator and the patient's skin, to act as a cooling agent to prevent skin burns and as a transferring agent to conduct the electromagnetic energy to the internal tumour tissue. However, there was no water bolus developed yet for the newest applicator at Erasmus MC: MRcollar.

The final design, which can be seen below, is a flexible, 3D printed lattice structure which is made watertight by gluing and sealing a plastic film around it.

By implementing flexible, zigzag water channels in the structure, an equal water distribution throughout the bolus volume could be achieved. The shape is designed to anatomically follow the shape of the head, ensuring a good connection to the skin and reducing the pressure on the patients' head. Additionally, the lattice is optimized to be as flexible as possible to adapt to the skin, but still stable enough to maintain its predefined shape. The new design was tested to be watertight and not disrupt the electromagnetic waves. Lastly, the improved sliding connection system makes it very easy for the clinicians to connect the bolus to the applicator.



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Ergonomic Water Bolus Design for Hyperthermia treatment of head and neck cancer patients.
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Integrated Product Design

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