SMARTPHONE-BASED PHOTOGRAMMETRY FOR CRANIAL DEFORMATION ANALYSIS

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Introduction

Cranial deformation is a common pathology that affects between 16% and 48% of infants.

Main effects
- Mostly aesthetical

Very severe cases:
- Auditory and visual (strabismus)
- Elevated Intracranial Pressure (ICP)

Common methodologies for measurement
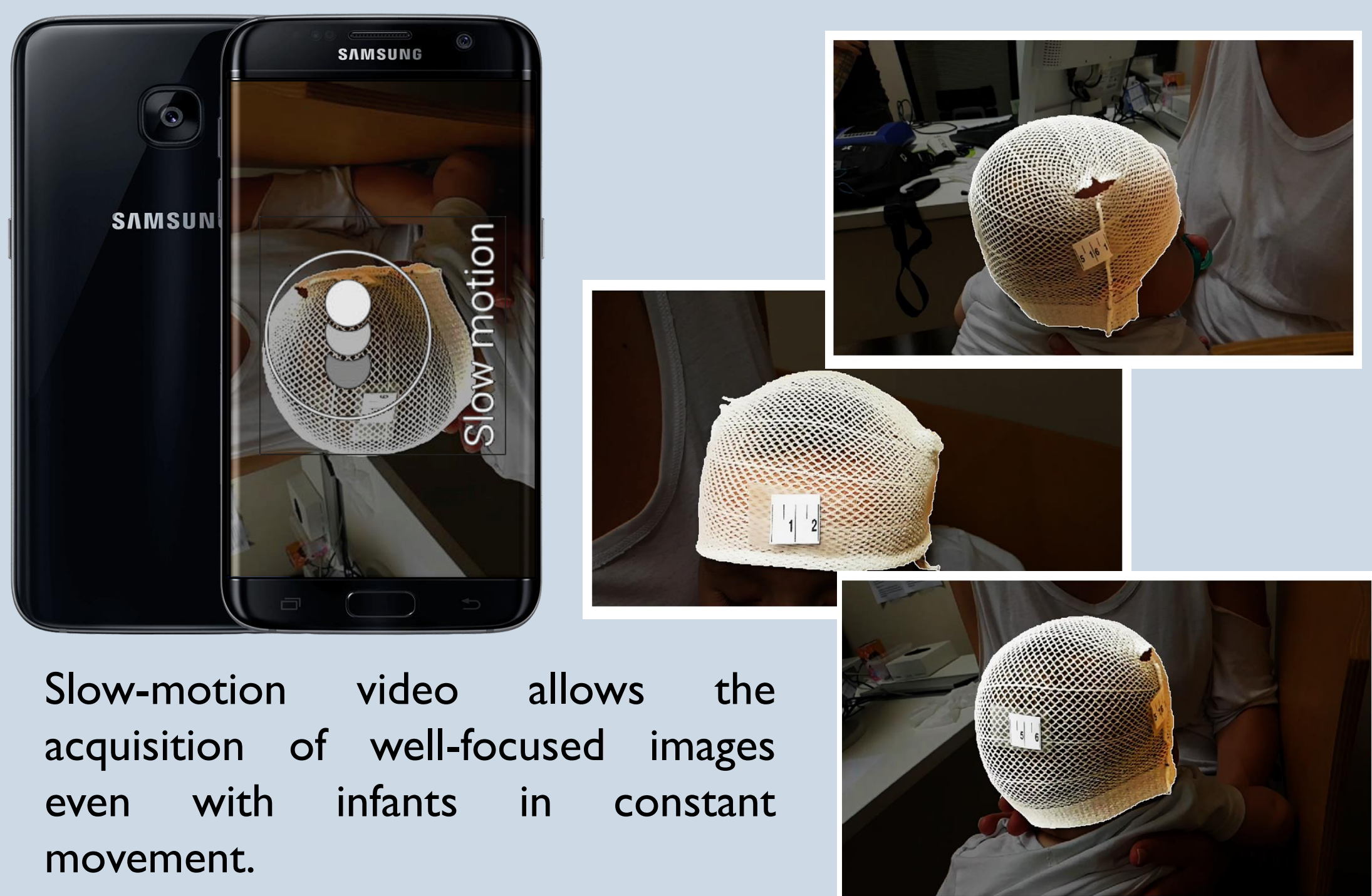- Calliper
- Radiological tests
- 3D imaging

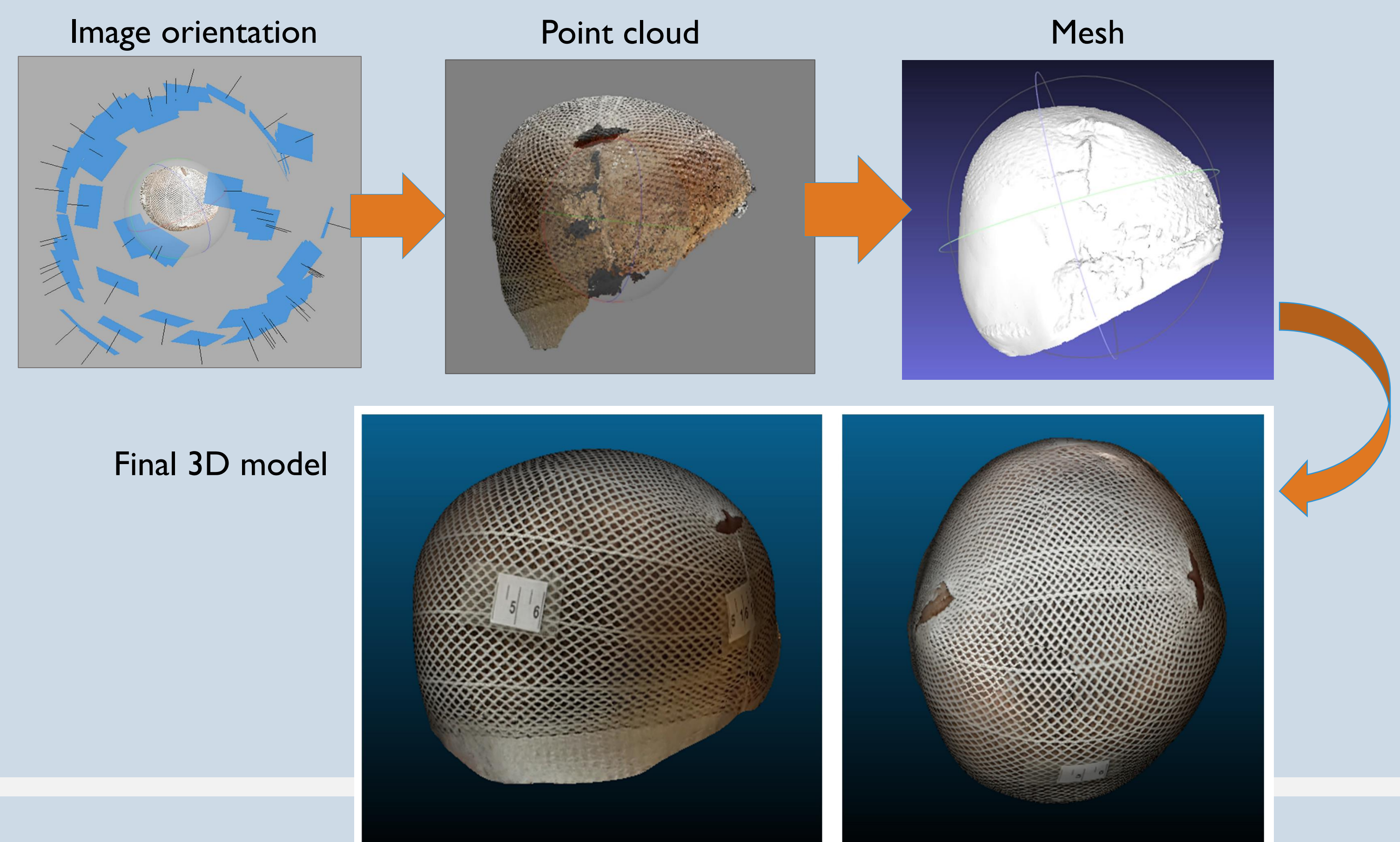Not enough information/highly invasive/costly

Proposed methodology
- Low-cost
- Non-invasive
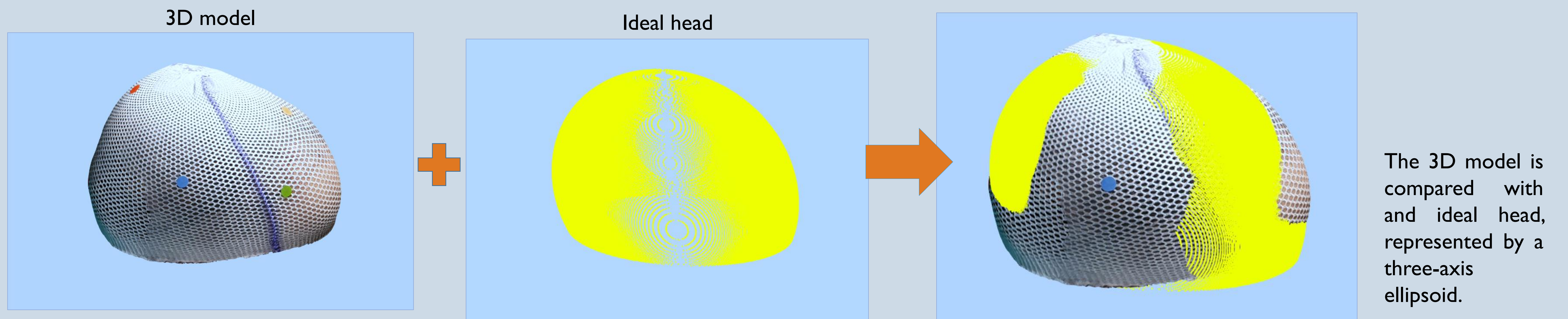- Detailed and accurate information

Methodology

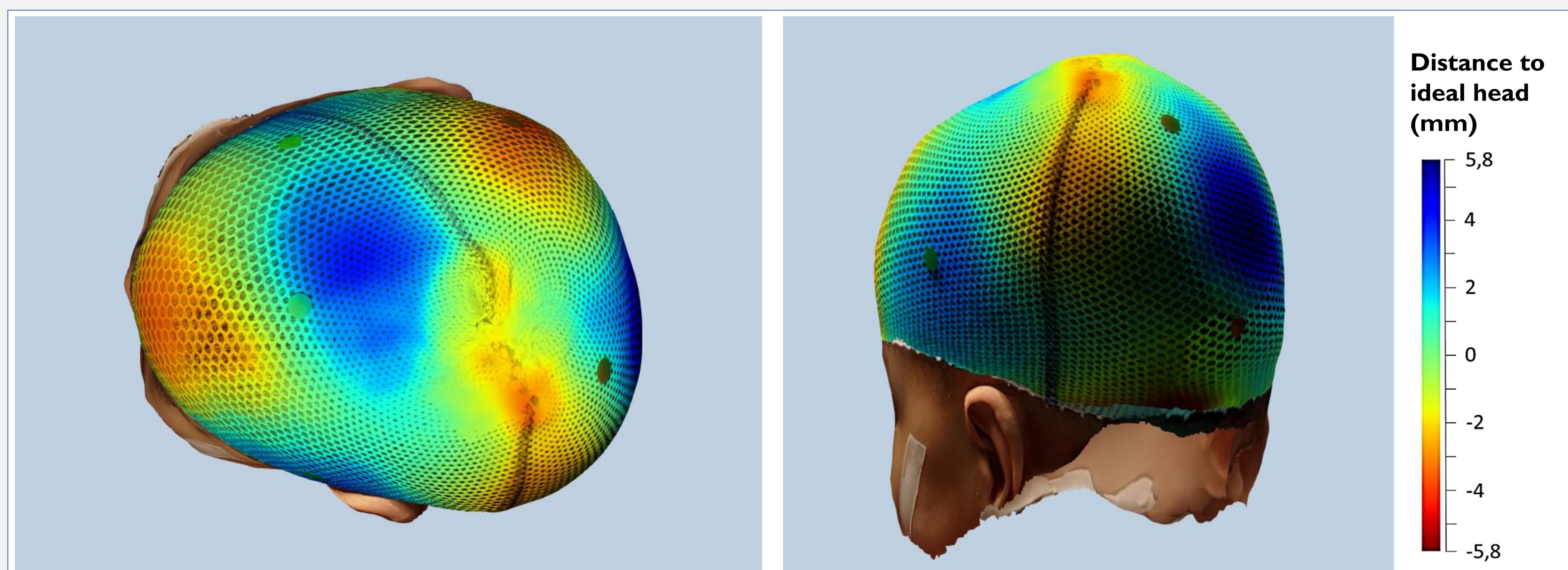### 1. Slow-motion video acquisition using a smartphone

Slow-motion video allows the acquisition of well-focused images even with infants in constant movement.

2. Model creation

Image orientation   Point cloud   Mesh

Final 3D model

3. Deformation analysis

3D model   Ideal head

The 3D model is compared with and ideal head, represented by a three-axis ellipsoid.

Visualization

Distance to ideal head (mm)

5,8
4
2
0
-2
-4
-5,8

Representation of cranial deformation as bathymetric colours on the 3D model

Conclusions

Photogrammetry and 3D modelling have been proved suitable techniques to evaluate cranial deformation. A novel low-cost and non-invasive methodology is presented, smartphones can be used to effectively allow doctors the chance to undertake rigorous 3D measurements and analysis independently of the medical centre, hospital or clinic. The acquisition of such objective data is essential for establishing correct diagnosis and monitoring outcomes for different cranial deformation pathologies.

The calculation of distances to an ideal head, represented by a three axis ellipsoid is presented as a new technique to evaluate the deformations.

Future lines of work include the comparison of the results with radiological measurements such as Tomography Scanner and Magnetic Radiological Imaging. A further automation of the methodology is also being carried out.

References

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