

# FDM printing in CMF – Surgery

Opportunities and risks in the global  
competitive market



Fabian Hipp  
Head of AM Medical Implants





# AGENDA

## 01 INTRODUCTION Anton Hipp

## 02 PSI IMPLANTS CMF - Surgery

## 03 FDM BENDING TECHNOLOGY

- Process
- Facts & dates
- Potentials

## 04 PEEK PRINTING TECHNOLOGY

- Material properties
- Printing technology / Process Parameters
- Facts & dates
- Potentials





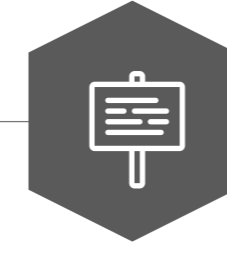
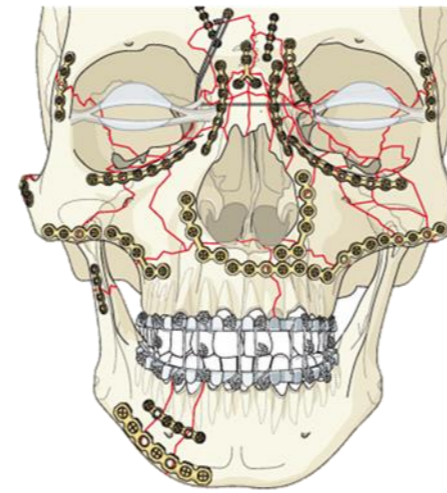
# 01 INTRODUCTION



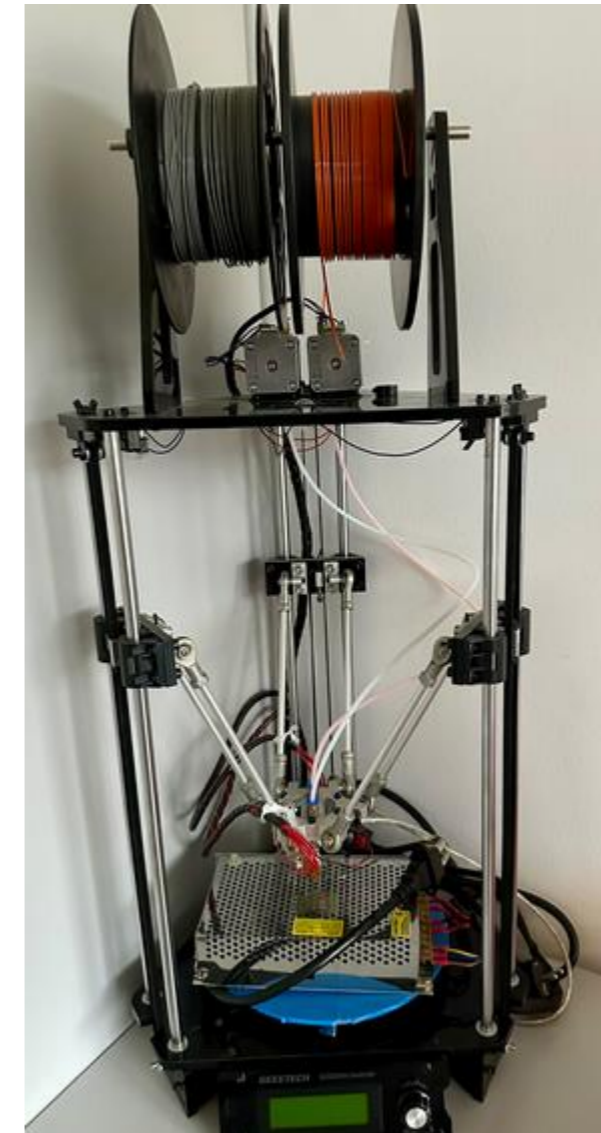
1970  
COMPANY FOUNDATION



1996  
IMPLANTS FOR MAXILOFACIAL



2021  
3D COMPETENCE CENTER



2024  
3D REGISTRATION PROCESS  
Including three FDM printer





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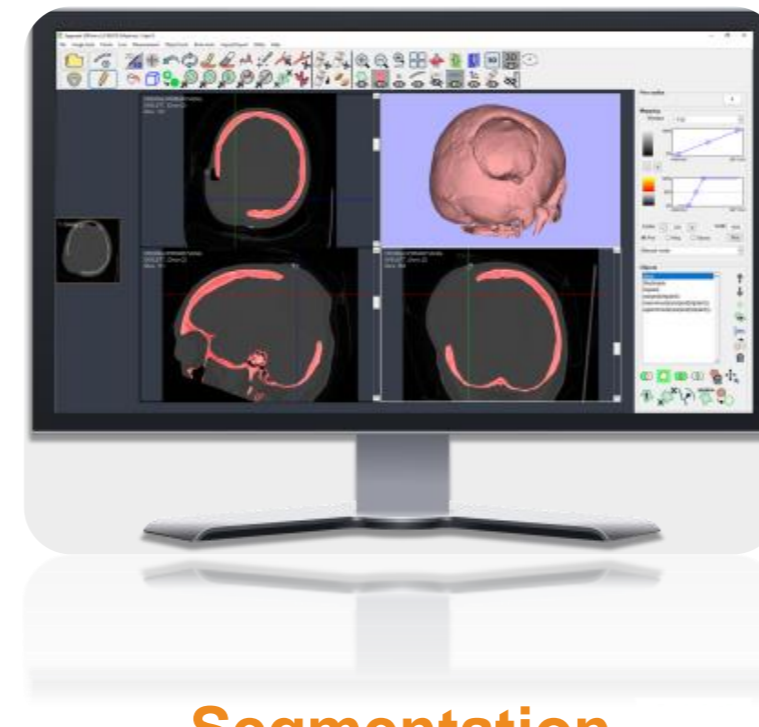
# 02 PSI Implants CMF - Surgery

## Computer-assisted Surgery (CAS)

*“Computer-assisted surgery (also called image-guided surgery) is a broad term used to indicate an operation in which imaging scans and computer technology are used to make a three-dimensional (3-D) model of an organ or bones.”*



CT- Scan



Segmentation  
& Implant  
design



printing





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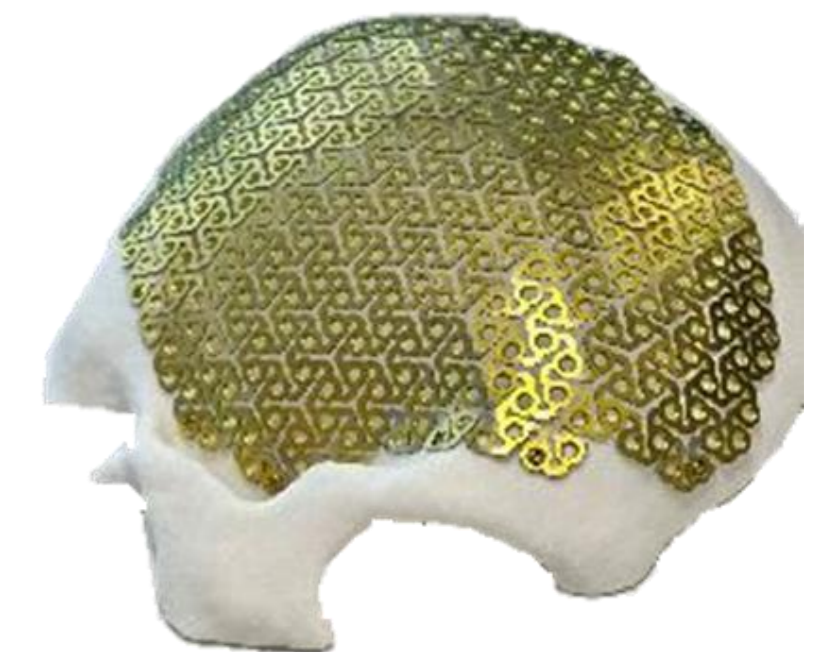
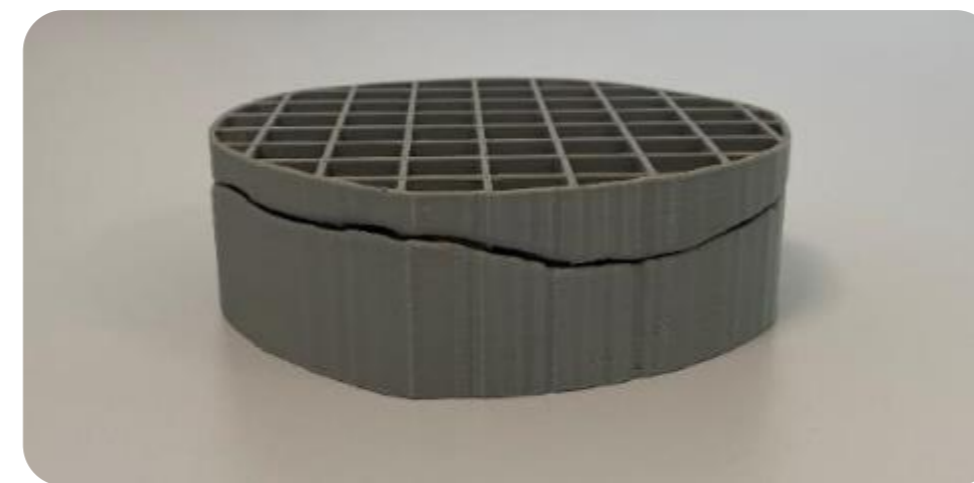
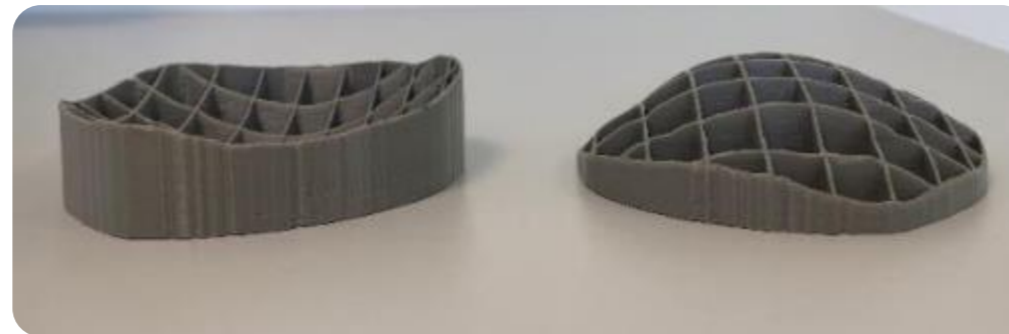
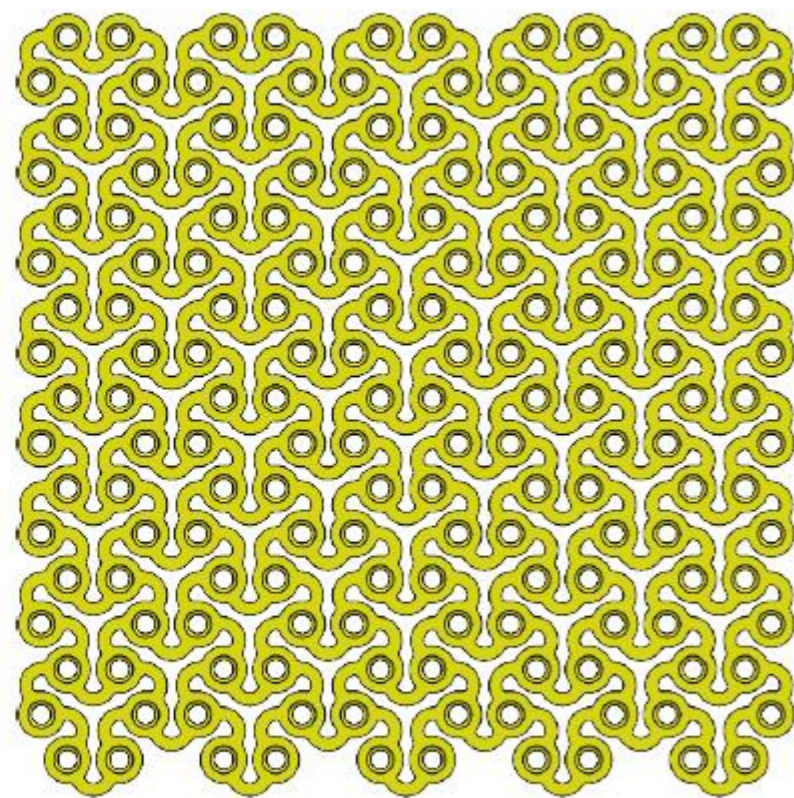
# 03 FDM Bending Technology

## Automated design process for Cranial mesh bending tools

*Together with a Swedish partner we developed a process for pre bent cranial titanium meshes*

Stärke 0,6mm Thickness 0,6mm

90 x 90 x 0,6 mm  
12.180.06  
120 x 120 x 0,6 mm  
12.181.06  
150 x 150 x 0,6 mm  
12.185.06  
200 x 200 x 0,6 mm  
12.186.06

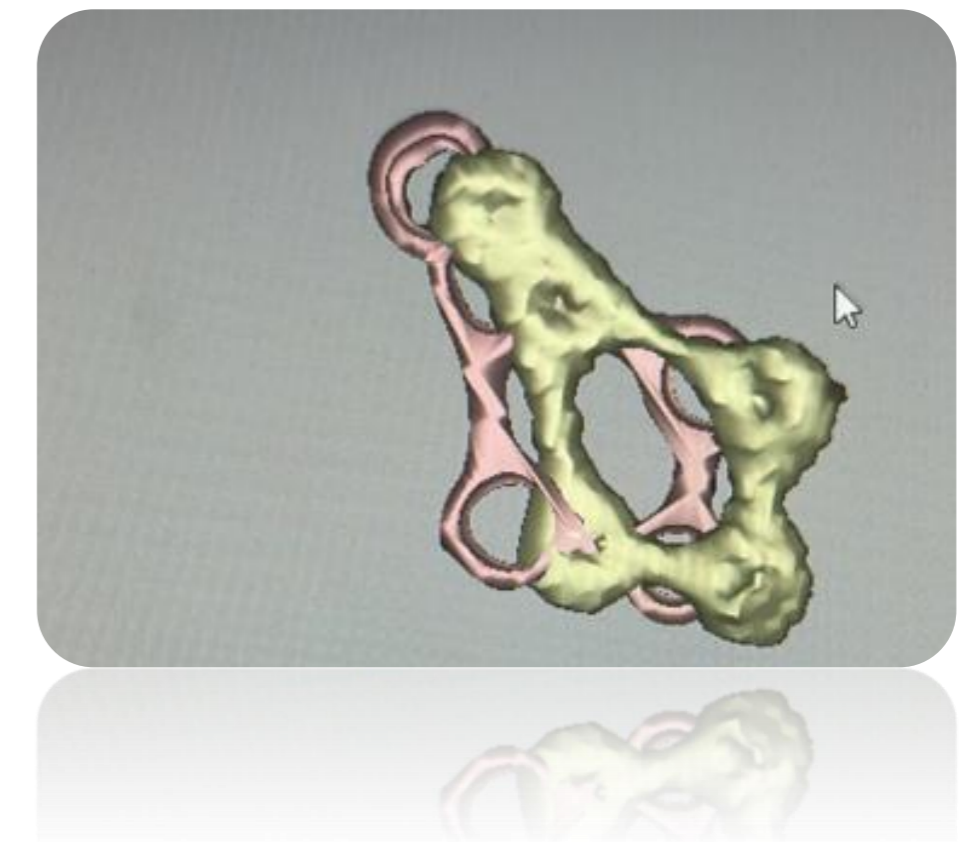
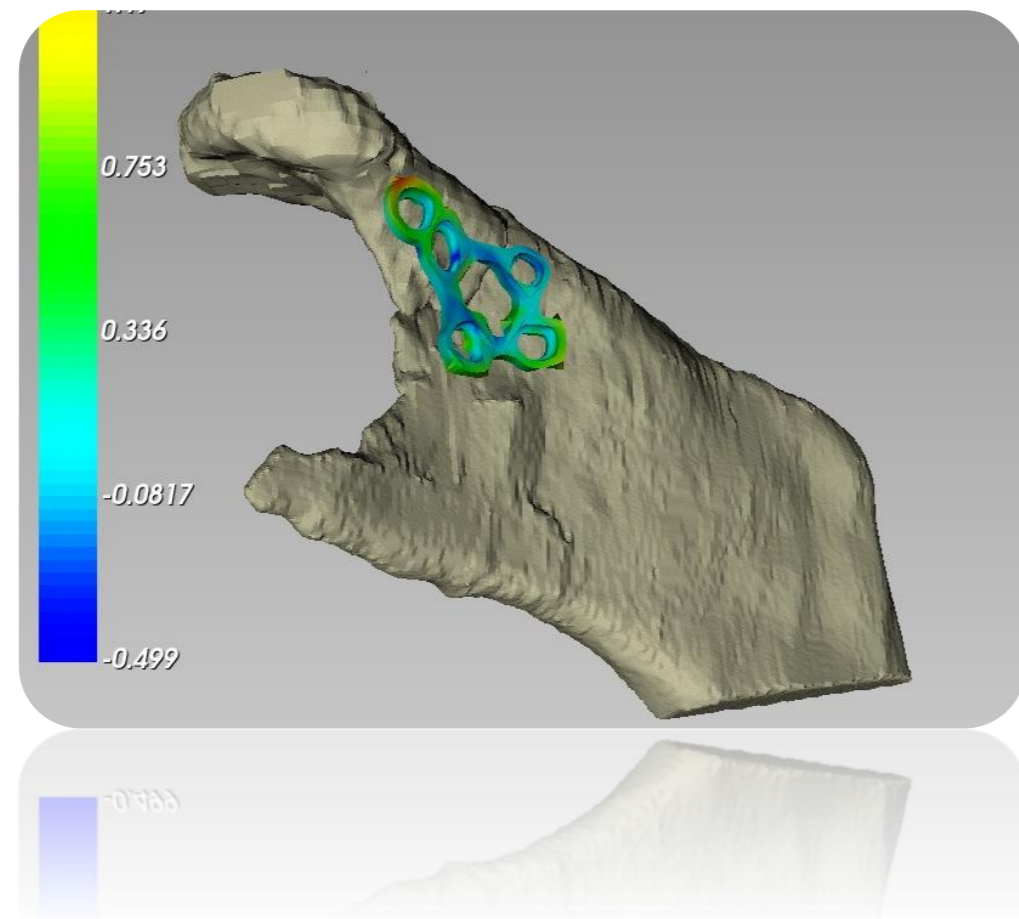




# 03 FDM Bending Technology

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## Clinical study UKD Dresden



Conclusion:

- drill guides are needed.
- However, pre-bending the plates has a positive effect on the patient's healing process





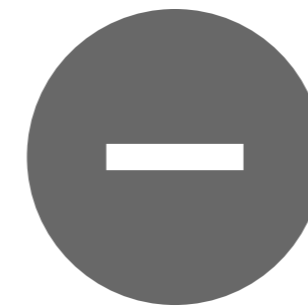
# 03 FDM Bending Technology

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## Pros & Cons



- *Saving surgery time*
- *Improved outcome with fewer complications*
- *Improved aesthetics*
- *length of the implants can be cut directly at the request of the doctor*
- *Instruments saving*
- *Cost-effective solution / low budget*



- *A little more planning effort*



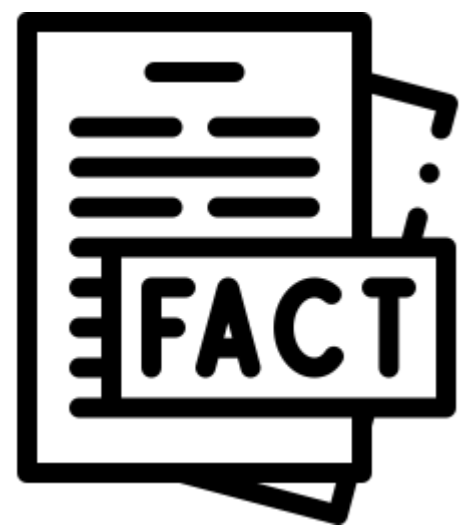
**This leads to improved patient care and is a cost-effective alternative in surgery**



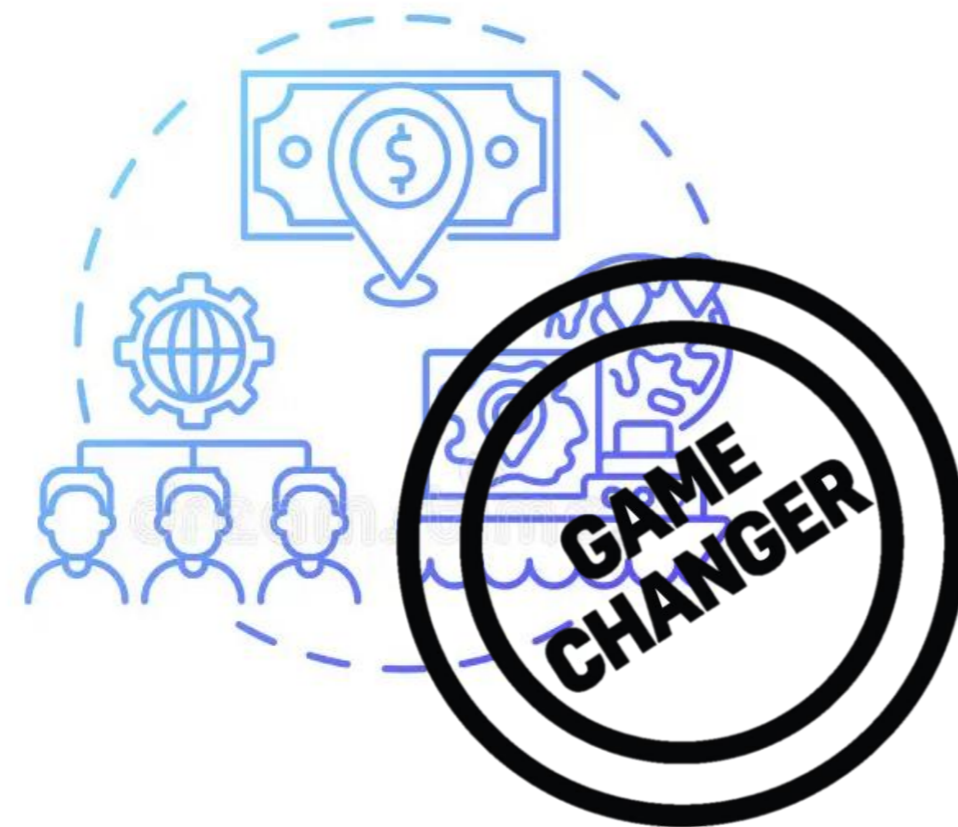


# 03 FDM Bending Technology

## Facts & Potentials



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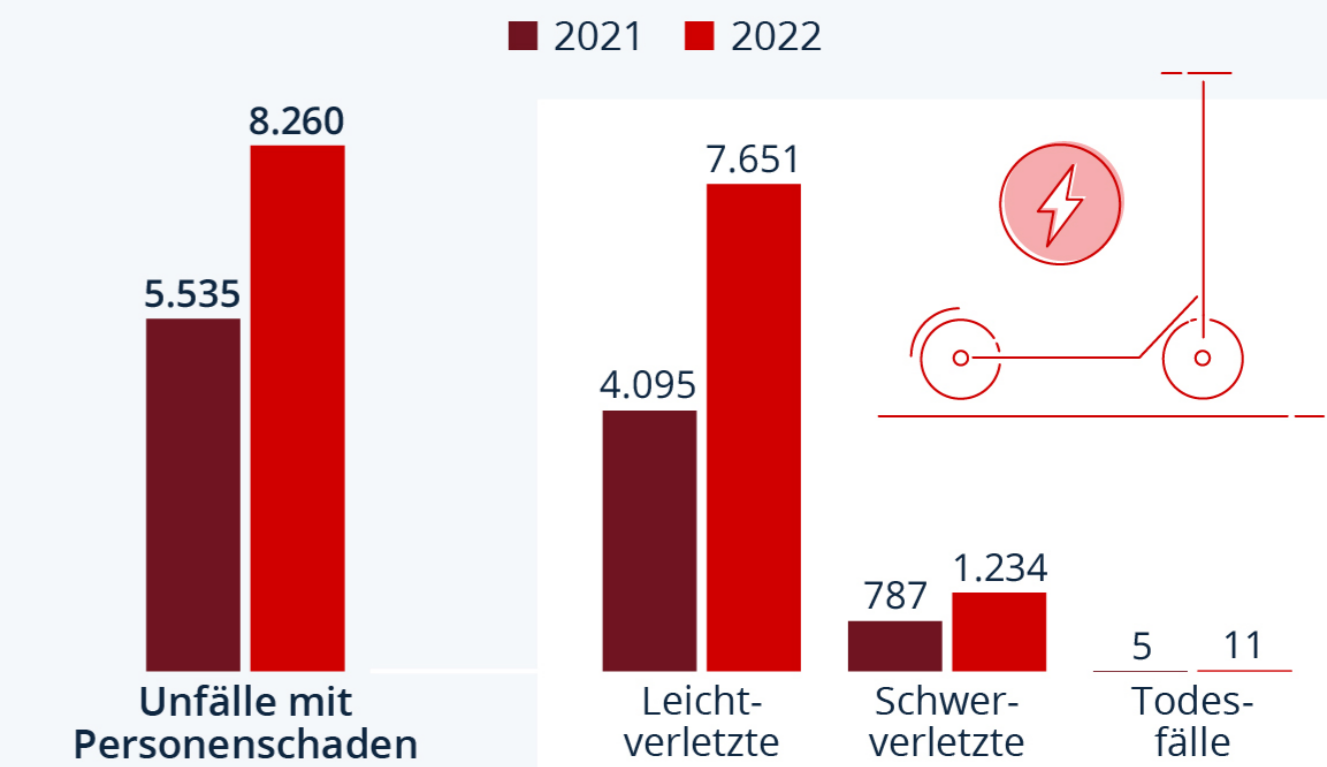


LOW-COST  
COUNTRY SOURCING



### Zahl der E-Scooter-Unfälle steigt um 49 Prozent

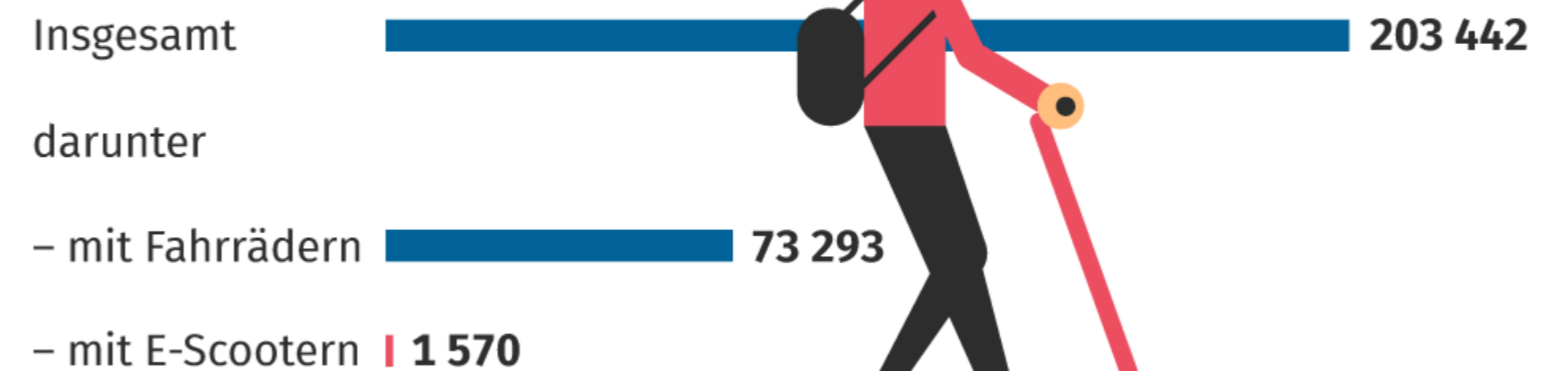
Anzahl der Unfälle mit E-Scootern in Deutschland



Quelle: Statistisches Bundesamt

### Unfälle mit Personenschaden

Januar bis September 2020



© Statistisches Bundesamt (Destatis), 2021



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# 04 PEEK Printing Technology

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## Material properties Polyetheretherketon (PEEK)

*PEEK is a thermoplastic semi-crystalline high-performance plastic.*



Permanent temperature resistance 260 °C



Very low coefficient of friction and high wear resistance



Excellent electrical insulation



Excellent temperature insulation



Excellent chemical resistance



Excellent machinability



Excellent resistance to radiation



High shrinking due to cooling



Warping in process

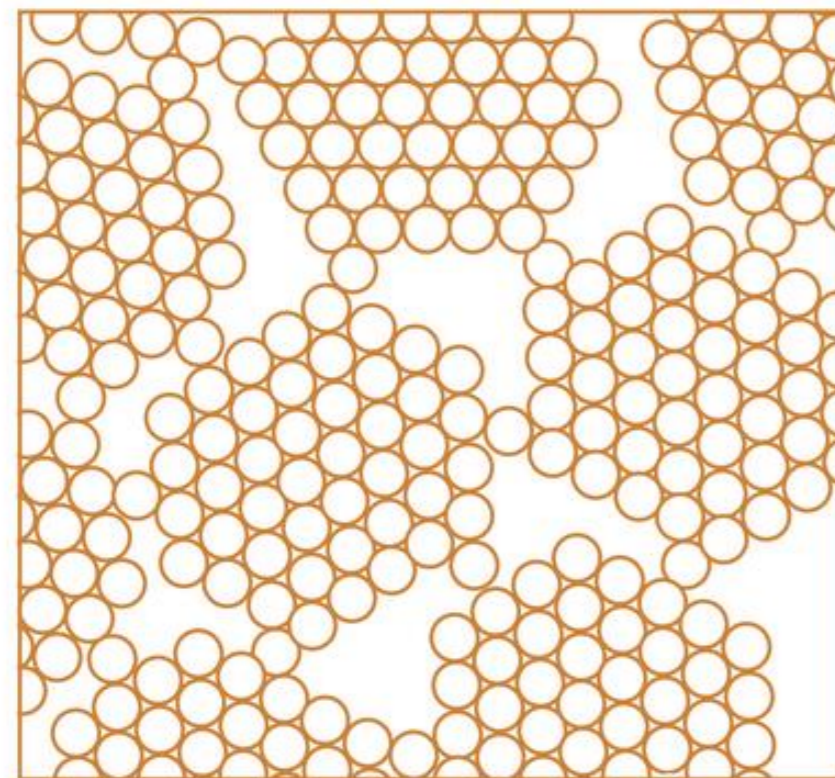




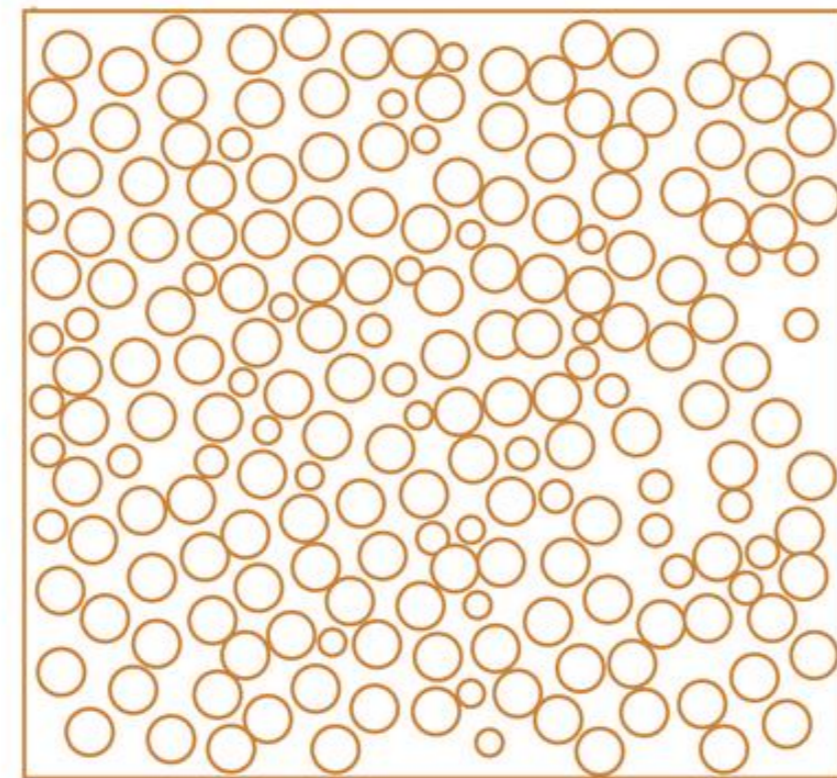
# 04 PEEK Printing Technology

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## Material properties Polyetheretherketon (PEEK)



Crystalline



Amorphous



### Properties of amorphous PEEK

- *Increased elasticity*
- *Higher specific heat capacity*
- *better optical transparency*

### Properties of Crystallin PEEK

- *Increased tensile strength and stiffness*
- *Increased resistance to solvents*
- *Increased barrier effect against gases and vapors*
- *High resistance to stress cracking*

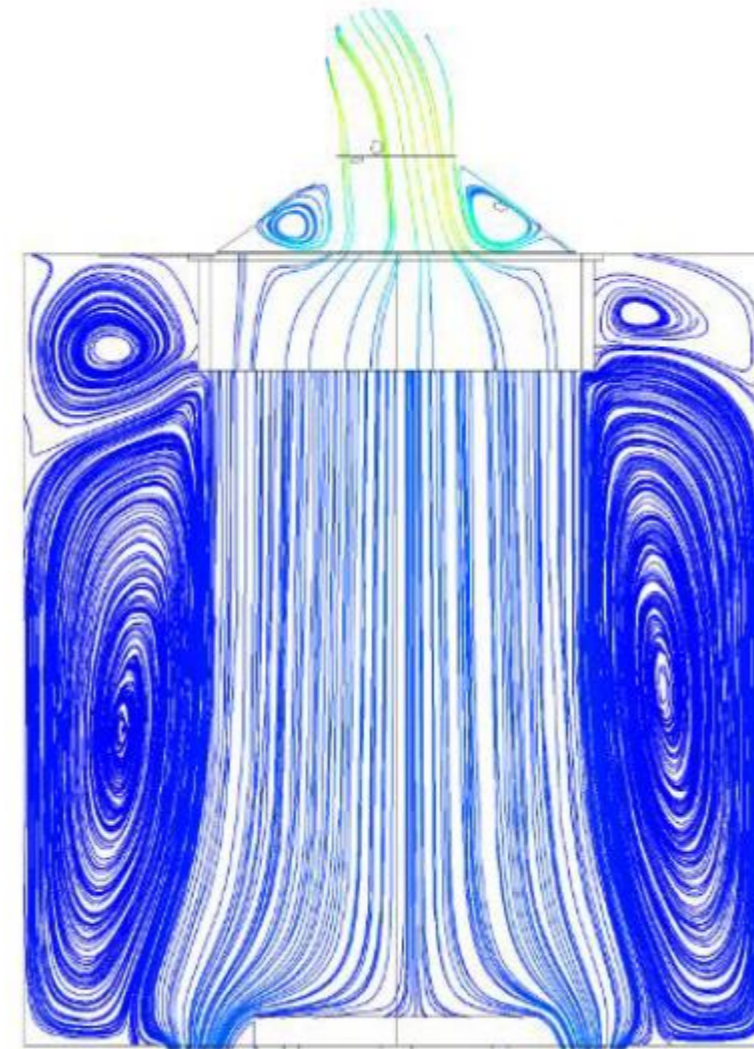




# 04 PEEK Printing Technology

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## Printing technology / Process Parameters



### technology

- *Filament based material extrusion technology*
- *Reproducible printing within full build envelope*
- *( $\varnothing$  200 mm, height 180)*
- *printing in laminar air stream*

### Product range

*Cranial Implant size from*

- *35x35x3 mm*

*Up to*

- *150x150x6mm*

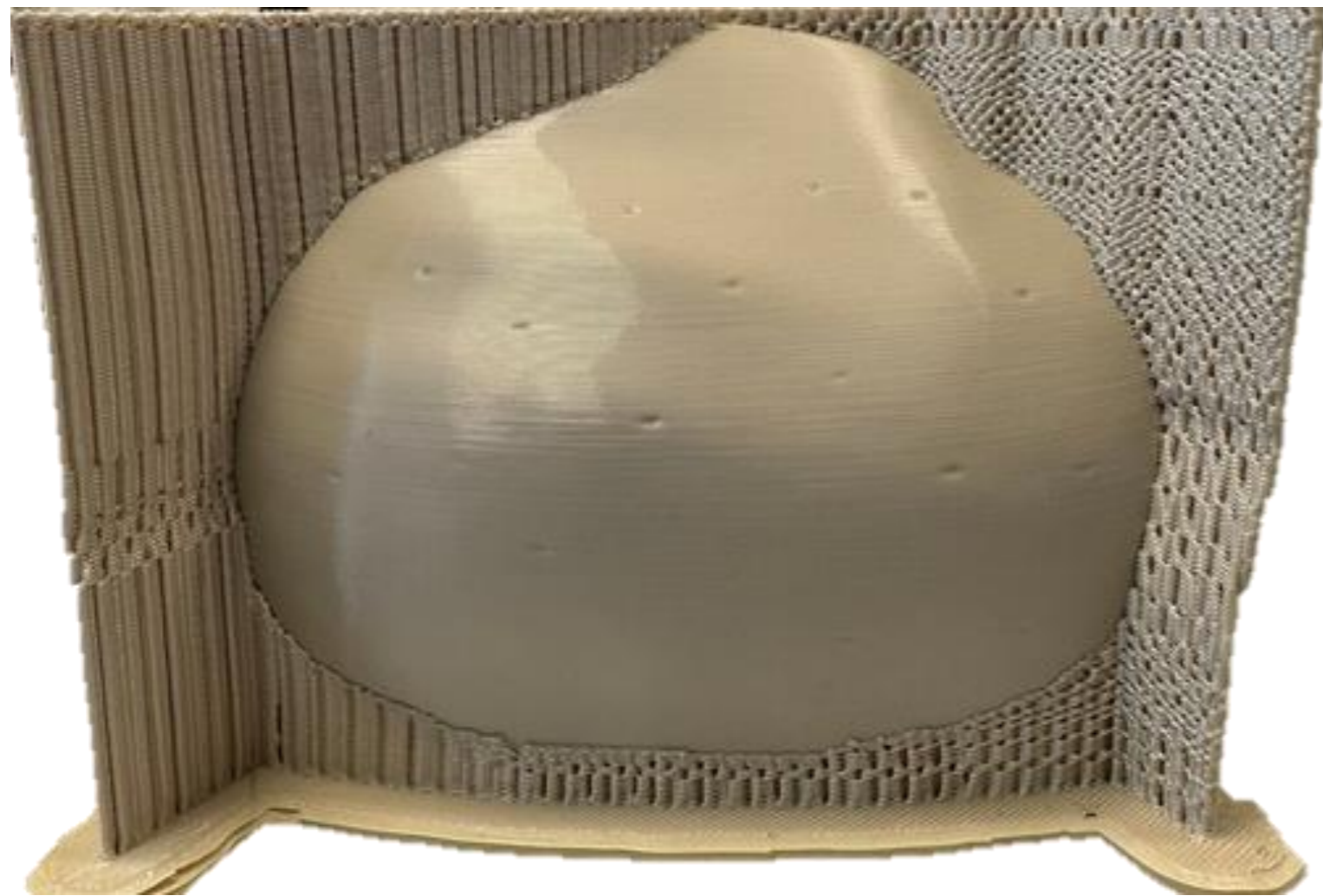




# 04 PEEK Printing Technology

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Prints & Process steps to final implant





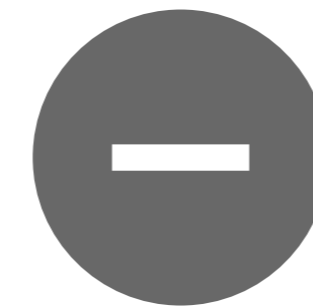
# 04 PEEK Printing Technology

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## Pros & Cons



- *Saving surgery time*
- *Improved outcome with fewer complications*
- *Improved aesthetics*
- *Instruments saving*
- **No or less titanium - better patient conscience well-being**
- **Lower weight**



- *Higher planning effort*
- *More expensive than titanium implant*

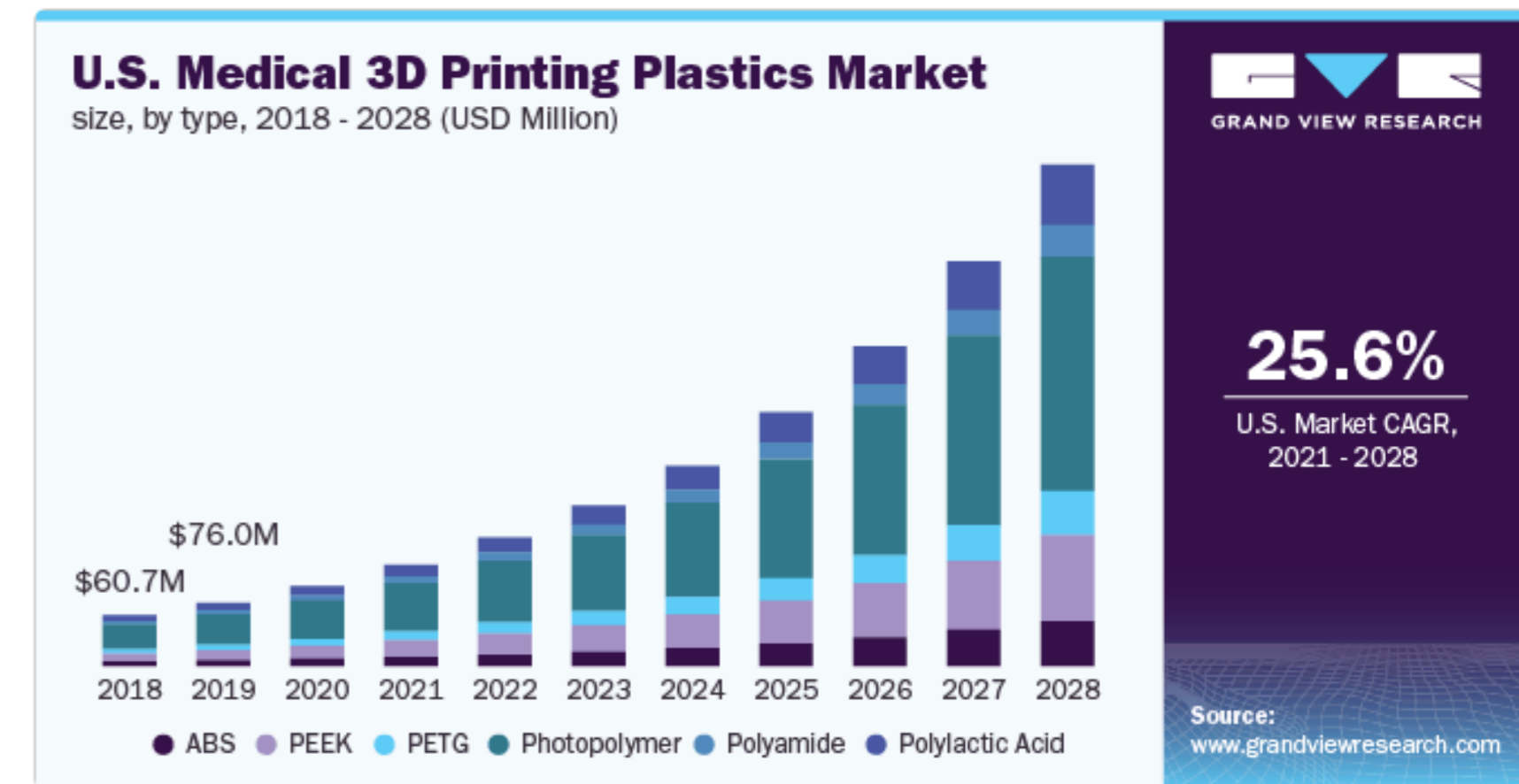
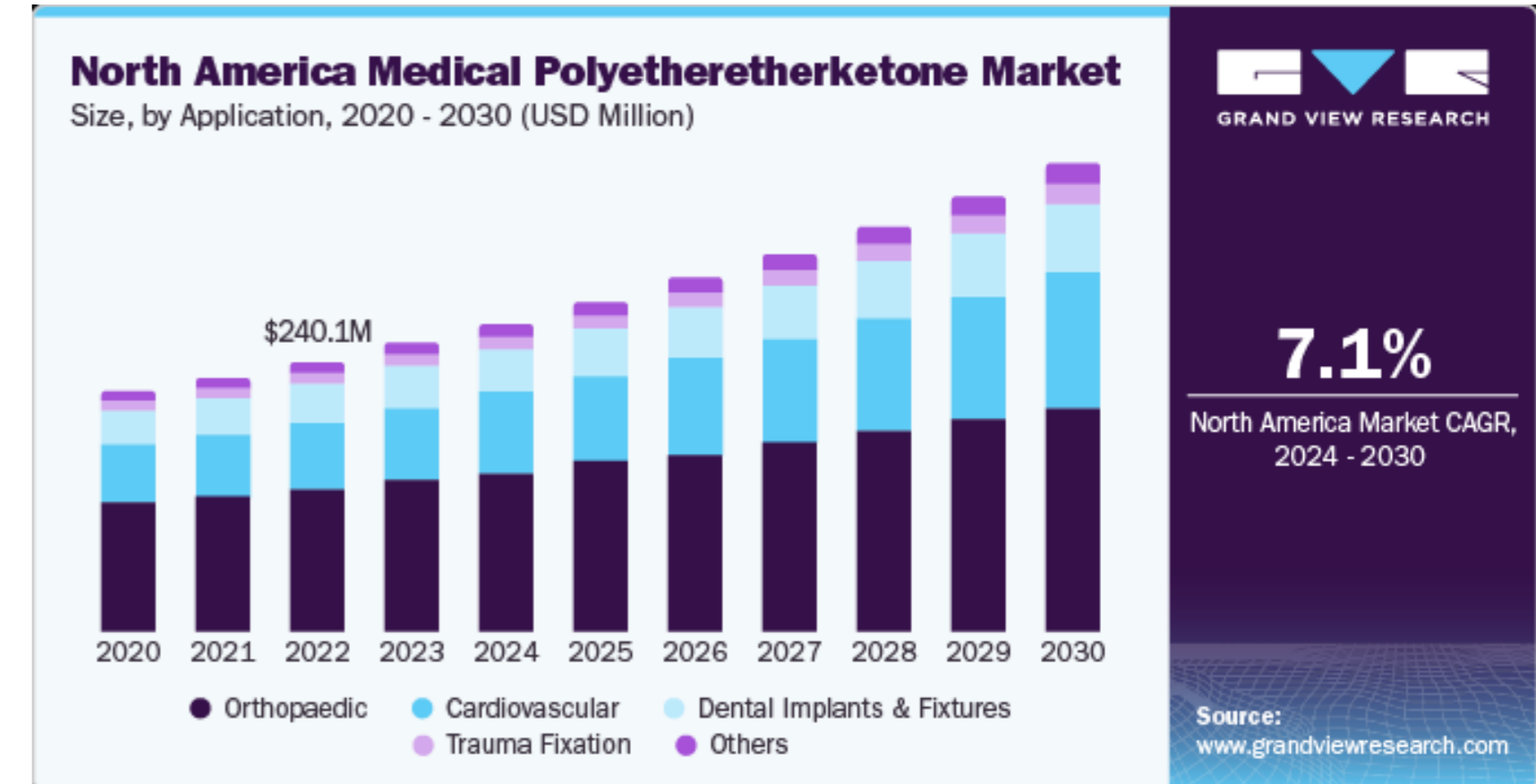
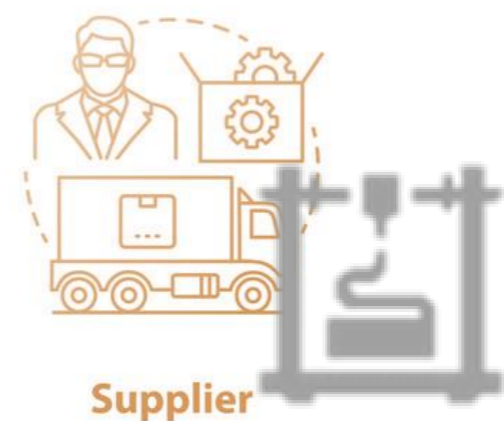
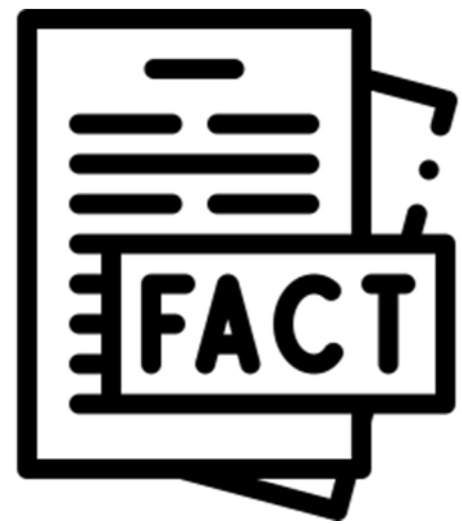
**This leads to improved patient care**





# 04 PEEK Printing Technology

## Facts & Potentials





# 04 PEEK Printing Technology

## Risk in the global market



LOGISTICS



SEGMENTATION SOFTWARE



REGULATIONS



DATA SECURITY



PLANNING

RESULT

VIRTUAL VS REALITY





**THANK YOU FOR  
YOUR ATTENTION**

**ANY QUESTIONS?**





# CONTACT US

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