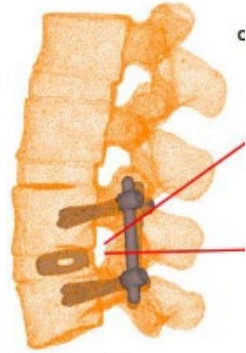# POLYMERIC SPINAL CAGE DEVELOPED VIA CT-FEA

INVENTOR: DR. MUHAMMAD HILMI BIN JALIL
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CO-INVENTORS: DR. MOHD NADZERI OMAR, DR. MUHD HAZLI MAZLAN,
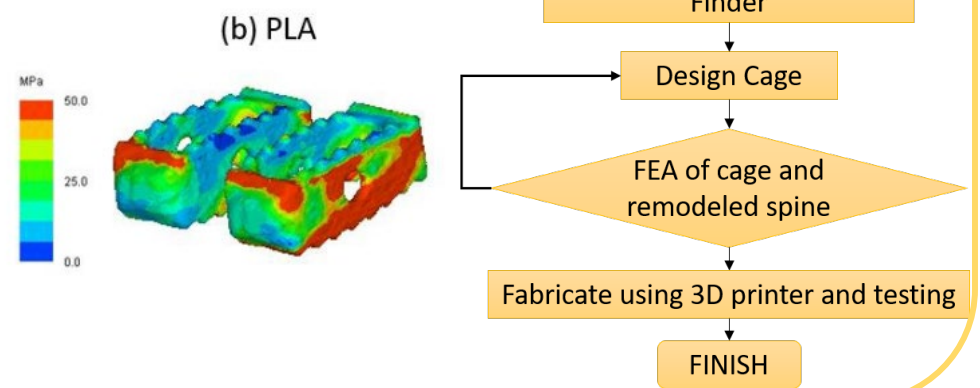KUGENDRAN A/L MAHENDRAN, MOHD FIRDAUS BIN MAK NANYAN

Product Background

- **To treat back pain, PLIF procedure using cage is done.**
- **Main problem:**
  - ❋ **Stress shielding**
  - ❋ **No FEA for prediction of failure.**
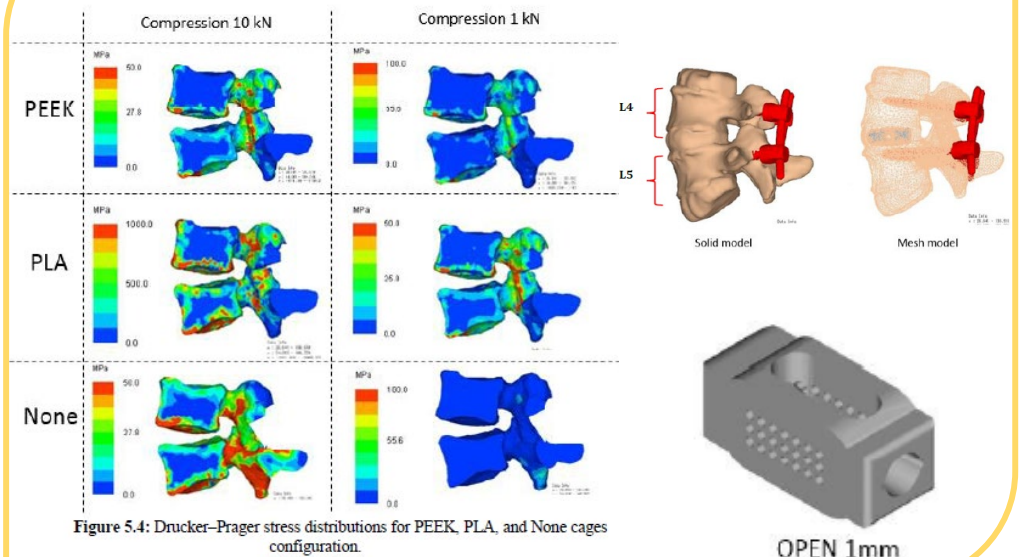 - ❋ **High material cost**

Novelty/ Originality/ Inventiveness

- ❋ **Current** marketed has **not been fully optimised** with the implementation of porous holes.
- ❋ The **implementation of porous** structures optimized using **CT-FEA.**
- ❋ Porous holes are a requirement for the **bone graft fusion** two adjacent vertebraes
- ❋ Material used : **Poly lactic acid (PLA)**

Benefits/Usefulness/ Applicability

- ❋ **Biomaterial-bioresorbable and cheaper.**
- ❋ **Avoid stress shielding- better life quality for patients**
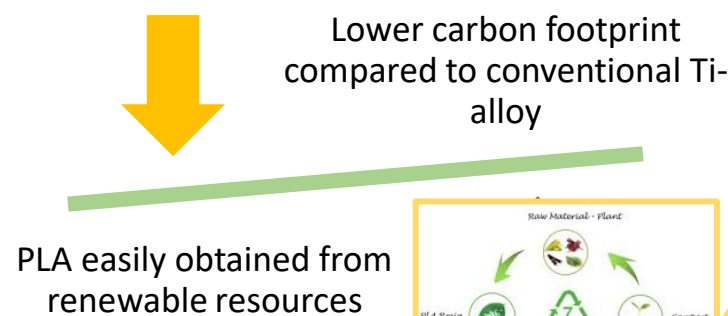- ❋ **Fail prediction- using FEA to predict cage behavior**

State of the Art/ Methods

- **FEA of PLA cage designed via CT-images**

(b) PLA

START → CT scan of patient → Remodel using Mechanical Finder → Design Cage → FEA of cage and remodeled spine → Fabricate using 3D printer and testing → FINISH

Product Image and Product Characteristics/Results

Figure 5.4: Drucker–Prager stress distributions for PEEK, PLA, and None cages configuration.

OPEN 1mm

Cost Analysis

- ❋ Cost of **conventional** spinal fusion in Malaysia are between **RM18k~RM 20k**
- ❋ PLA is **20% cheaper** than **Ti-alloy** and **50**% than **PEEK**.

Environmental Impact

Lower carbon footprint compared to conventional Ti-alloy

PLA easily obtained from renewable resources

Marketability & Commercialisation

- ❋ PLIF and TLIF **procedures** are **high**, with reported **arthrodesis** rates between **77% and 100%**
- ❋ In **Malaysia**, the **prevalence** of back pain was found to be **12%.**
- ❋ **16%(5.12 million)** of Malaysia population is **54 years old** above.
- ❋ The percentage will **increase worldwide** as **lifestyle changed** due to the **pandemic.**

Status of Innovation

- ❋ **Product Development is at concept development**
- ❋ **TRL Level 3: Research to prove faesibility**
- ❋ **Model**

Publication

- ❋ **Biomechanical Comparison of Polymeric Spinal Cages Using Ct Based Finite Element Method, International Journal of Bioscience, Biochemistry and Bioinformatics, 7, 119-117, 2017**
- ❋ **Chapter 4:Biomechanical Analysis Of Posterior Lumbar Interbody Cages, Advanced Computer Modelling and Electronics Engineering Series 1, Penerbit UTHM, 2020**

Collaboration/Industrial Partner

UTHM Universiti Tun Hussein Onn Malaysia

HUMEN Human Engineering Research Group

KYUSHU UNIVERSITY