1. Glaucoma: Silent Thief of Sight

Risk factors:
- Age
- Ethnicity
- Dysfunctional trabecular meshwork
- Increased eye pressure

Symptoms:
- None in early stages
- Gradual loss of peripheral vision

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<tr>
<th>Glaucoma</th>
<th>Current UK Burden</th>
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<td>£36 billion</td>
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<td>708,000 people living with glaucoma*</td>
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<td>44% increase in demand for glaucoma services by 2035†</td>
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<td>UK cases set to rise by nearly 50% by 2035‡</td>
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Interventions:
- Treatments aim to lower eye pressure
- Eye drops
- Invasive surgery
- All slow progression of glaucoma
- None repair or regenerate the trabecular meshwork
- An unmet clinical need remains

Could biomaterials be the next frontier in developing a new glaucoma treatment?

2. Biomaterials – What are they?

Think! Hip replacement, contact lenses, dental fillings

Contact Lens

Figure 2: Examples of common biomaterials for the eye

Materials that work with the body for a medical purpose

3. Using Biomaterials to Manufacture an Artificial Trabecular Meshwork

Electrospinning is a fibre production technique which can generate micro-environments that resemble the trabecular meshwork.

- Electrospun scaffolds were initially used as filtration devices, which is the same functionality as the trabecular meshwork.

Research aim

To replace diseased trabecular meshwork with a biomaterial scaffold

4. Production of Artificial Trabecular Meshwork Biomaterial Scaffold

Trabecular Meshwork

Top of Trabecular Meshwork
- More open
- Large fibres
- Large pores

Bottom of Trabecular Meshwork
- More compact
- Small fibres
- Small pores

Biomaterial Scaffold

Top of Biomaterial
- More open
- Large fibres
- Large pores

Bottom of Biomaterial
- More compact
- Small fibres
- Small pores

Figure 4: 3D and 2D images of human trabecular meshwork (left) and biomaterial scaffold (right)

Successfully manufactured a biomaterial scaffold that replicates the trabecular meshwork structure. But can they support cell attachment and growth?

5. Trabecular Meshwork Cell Growth on Biomaterial Scaffold

Trabecular Meshwork with cells

Biomaterial Scaffold with cells

Figure 5: Scanning electron micrographs of human trabecular meshwork cells on human tissue (left) and biomaterial scaffold (right). (Redarrows pinpoint position of trabecular meshwork cells)

6. Conclusions

- Glaucoma is an ever-growing problem and an unmet clinical need for a new treatment remains.
- We have successfully manufactured a biomaterial scaffold that imitates trabecular meshwork structure using electrospinning.
- This biomaterial scaffold supports trabecular meshwork cell attachment and growth.
- Biomaterial scaffolds offer potential to be a novel, regenerative treatment for glaucoma.

Next Steps: To assess function of biomaterial scaffold in relevant 3D models

STOP THIEF! USING BIOMATERIALS TO TACKLE GLAUCOMA

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