An investigation into cell seeding efficiency on dermal scaffolds for in vitro pre-clinical studies


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BACKGROUND

• The demand for tissue-engineered dermal scaffolds for full thickness skin wounds continues as current treatments are inefficient.

• Dermal scaffolds undergo rigorous in vitro and in vivo testing to fine-tune their optimal properties for efficient wound healing.

• During in vitro cell studies the percentage of seeded cells that adhere to the scaffolds is low and its importance overlooked.

• Inefficient cell seeding slows in vitro experiments and are costly in terms of resources and time.

AIM

• To investigate optimum conditions to improve cell seeding efficiency on dermal scaffolds for in vitro pre-clinical studies.

• We hypothesised that synergy of variable affects cell seeding efficiency.

MATERIALS AND METHODS

1) Cell passage number (5 and 10)
2) Cell seeding density (1.25x10^5, 2.5x10^5 or 5x10^5 in 200 µl) per scaffold
3) Scaffold disc to well plate surface area ratio (1:1 or 1:6)
4) Attachment incubation time at 37°C with 5% CO2 (3h or 24h)

Matrix of variables filled with results (% of cells remaining on scaffolds) to visually observe how synergy of variables affects cells seeding efficiency:

RESULTS

• Data was plotted in 2D and 3D graphs.

• Attachment incubation time (p<0.001 for both scaffolds) and scaffold to well plate surface area ratio (p<0.001 for both scaffolds), followed by the cell passage number only for Integra® (p=0.003), had the largest effect on seeding efficiency.

• The highest efficiencies were obtained at the lowest density (1.25x10^5) for both P5 and P10, which suggests that lower seeding densities may result in less cell wastage.

CONCLUSIONS

• A synergy of different variables affects cell seeding efficiency onto dermal scaffolds, which should be investigated for each individual material.

• Optimisation of cell seeding efficiency on dermal scaffolds for pre-clinical in vitro studies can save time and resources.

• This study can be easily translated to other biomaterials and cell types.