Automated Stem Cell Separation  

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INTRODUCTION

- Stem cells are able to replace unhealthy cells and can be used to treat spinal cord injury, heart disease, arthritis, burns, etc.
- Adult adipose tissue is a plentiful source of stem cells.
- Current chemical processes break apart adipose tissue.
- Chemical Processes are not approved by the FDA.

Problem Statement: To create a device capable of mechanically breaking apart adipose tissue to release stem cells for regenerative medicine.

SOLUTION: CAVITATION

- Human fat tissue, obtained through liposuction, is run through the device.
- Shock waves cause the tissue holding the cells together to burst.
- The strength of the stem cells themselves is great enough to prevent their breakdown.

RESULTS

- Fluid velocity increases.
- Fluid pressure drops with increased velocity.
- Pressure drops low enough to initiate a phase change.
- Bubbles of vapor form and subsequently collapse, releasing a shockwave.

Adipose Breakdown Ratio to input 3:1 10:1 6:1 10:1
Mechanical (Meets FDA Regulations) Boolean - True True True
Viability of Stem Cells % of collagenase > 50% > 70% 933% 2167%

CONCLUSIONS

- Due to the fact that too few tests were run, these results are inconclusive regarding comparison to chemical methods, but valuable regarding which mechanical design is more effective.
- This device is only one step in what could be a larger system used to harvest stem cells to be reimplanted into a patient.
- This step is critical, as the process needs to break the tissue into isolated cells while maintaining viability.
- Later researchers can use what was learned here, and use the harvested stem cells after isolating them from non-stem cells.

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