Machine learning to predict mesenchymal stem cell efficacy for cartilage repair & a novel cell preservation solution

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Inconsistent therapeutic efficacy of mesenchymal stem cells (MSCs) in regenerative medicine has been documented in many clinical trials. Precise prediction on the therapeutic outcome of a MSC therapy based on the patients' conditions would provide valuable references for clinicians to decide the optimal treatment strategy. Such prediction is achievable through machine learning with neural network models. Herein, we have developed a neural network model to predict the outcomes of MSC therapies from a database of published *in vivo* and clinical studies. The unique features of our model in processing incomplete data entry and computing prediction uncertainty have enabled precise prediction of post-treatment cartilage repair scores with a coefficient of determination of 0.637 ± 0.005. From this model, we identified defect area percentage, defect depth percentage, implantation cell number, body weight, tissue source, and the type of cartilage damage as the most critical properties that significantly impact cartilage repair. A dosage of 17 - 25 million MSCs was found to be optimal for cartilage repair. Further, critical thresholds at 6% and 64% of cartilage damage area, and 22% and 56% in defect depth were predicted to significantly reduce the efficacy of MSC therapy. This study, for the first time, demonstrated machine learning of patient-specific cartilage repair post MSC therapy. This approach can be applied to identify and investigate more critical properties involved in MSC-induced cartilage repair, and adapted to study other clinical indications.

Separately, BTI has evaluated a new cell preservation media that was demonstrated to have better viability, recovery after thaw and cell growth compared to industry standard Cryostor. This novel preservation media X-Thrive, enabled cell growth recovery after thawing from between 20% to 240% improvement compared to Cryostor, in both monolayer and microcarrier cultures, and in serum as well as serum free conditions. Thus enabling a better recovery for stem cell manufacturing.