compare the SSD to SSU on sperm morphology and motility parameters objectively measured by a computer assisted sperm analyzer (CASA).

MATERIALS AND METHODS: Semen samples from 25 patients were assigned an accession number and de-identified. All semen specimens were randomly split between the two sperm separation methods. Liquefied semen (850 μL) was placed into the inlet port of the ZyMōt^{TM} SSD and the same volume was placed into a 15 ml centrifuge tube for SSU. Sperm washing medium (750 μL) was layered over the SSD membrane, and the same volume was layered on top of the semen specimen within the centrifuge tube for SSU. Both were incubated at 37 °C for 30 minutes. The sperm suspension (500 μL) was then drawn from the outlet port of the SSD, and 500 μL was removed from the top of the upper layer in the SSU tube. Two subsamples (6 μL each) from each treatment were analyzed using a Hamilton Thorne CEROS II CASA. Mean sperm parameters recorded included concentration, % motility, % progressive motility, path velocity (VAP), progressive velocity (VSL), track speed (VCL), lateral head amplitude (ALH), beat cross frequency (BCF), straightness (STR), linearity (LIN), elongation % and area. Normal morphology was read blindly by one senior andrology technologist and recorded. The data was analyzed via Statistical Analysis System utilizing a matched pairs t-test comparing SSD to SSU. Significance was defined as $p<0.05$.

RESULTS: Two sperm parameters were higher after SSD separation compared to SSU including concentration (21.2 vs 16.99 M/mL; p= 0.0023) and mean ALH (4.16 vs 3.99 μm; p=0.0081). However, several more motility parameters were higher after SSU compared to SSD including VAP (90.07 vs 92.24 μm/s; p=0.0410), VSL (82.69 vs 85.22 μm/s; p=0.0250), BCF (29.42 vs 31.05 Hz; p=0.0001), STR (90.4 vs 91.16 %; p=0.0271) and LIN (68.48 vs 70.28%; p=0.0055.) There was no significant difference seen in % normal morphology.

CONCLUSIONS: In our study, SSD prepared sperm resulted in a higher concentration of sperm while SSU prepared sperm resulted in higher motility parameters. Therefore, different sperm quality parameters may be optimized by different sperm separation techniques.

IMPACT STATEMENT: ZyMōt^{TM} SSD prepared sperm have been previously reported to have less DNA fragmentation. In our study, SSU prepared sperm resulted in higher sperm motility parameters compared to SSD. This may suggest that multiple factors may contribute to sperm quality and can be optimized by different sperm separation techniques. More research should be performed to elucidate sperm parameters and their relationship to sperm quality and its impact on fertility outcomes.

P-114 6:30 AM Tuesday, October 19, 2021

AN ARTIFICIAL NEURAL NETWORK IS CAPABLE OF ACCURATELY IDENTIFYING BLASTOCYSTS WITHIN THE CULTURE WELL.

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OBJECTIVE: To determine whether the EMA artificial neural network (ANN) can precisely and consistently determine the presence of a blastocyst within the culture dish.

MATERIALS AND METHODS: Accurately locating a viable blastocyst, inside the well of the in-vitro embryo culture dish of time-lapse incubators, is a critical step in applying any automatic ANN blastocyst evaluation model, since embryos are occasionally displaced within the well, unfocused or covered with debris or bubbles. We tested the EMA ANN model on a retrospective dataset of 60,000 time-lapse sequences of viable embryos from a single center that were cultured until the blastocyst stage. The EMA ANN model ability to identify blastocysts inside the well was assessed using accuracy, sensitivity, and specificity values. The area under the ROC curves (AUC) was used to calculate performance evaluations.

RESULTS: The accuracy, sensitivity, and specificity values of the EMA ANN model for blastocyst detection were 0.99, 0.98 and 0.99, respectively. The corresponding AUC for blastocyst identification inside the culture well was 0.999.

CONCLUSIONS: The EMA ANN model showed an almost perfect capacity to accurately detect blastocysts within the culture dish in time-lapse sequences of viable embryos.

IMPACT STATEMENT: Neural network-based models for automated in-vitro evaluation of embryos were found to reliably and accurately detect blastocysts in the culture well, a crucial step for their effective implementation.

SUPPORT: This project has been supported by the Centro para el Desarrollo Tecnológico Industrial, EUREKA CDTI IDI-20191102.

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ADVANCED MORPHODYNAMICAL ANALYSIS OF EMBRYOS VERSUS AUTOMATIC MORPHOKINETIC ANNOTATIONS FOR OUTCOME PREDICTION; AN ARTIFICIAL NEURAL NETWORK ANALYSIS.

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OBJECTIVE: To assess and compare the discriminative capability of novel embryo morphodynamical parameters in predictive models of implantation rate based on deep learning algorithms. In addition, to analyse whether morphological variables in combination with novel or conventional morphokinetics parameters increase the model performance.

MATERIALS AND METHODS: This study included 812 single-blastocyst transfers cultured in time-lapse system (EmbryoScope®) and evaluated by two senior embryologists. Novel parameters were manually measured with the drawing tools of EmbryoViewer® according to Bori L. et al. 2020, including distance and speed of pronuclear migration, blastocyst expanded diameter, inner cell mass area and trophectoderm cell cycle length. Conventional morphokinetic parameters and morphological descriptive parameters were automatically annotated, including the division time to two cells (t2), three cells (t3), four cells (t4), five cells (t5) and the blastocyst formation (tB), the inner cell mass quality and the trophectoderm quality. These variables were studied independently and combining them.

The artificial neural network built was a typical architecture: multilayer perceptron (MLP). The MLP model had a hidden layer with 15 neurons. Dataset was divided into 80% for the training process, 10% for validation and 10% for blind test. Metrics used at Bori L. et al. were obtained to evaluate the performance of the trained models and, therefore, to compare predictive power of each set of parameters.

RESULTS: Results validated the study performed in Bori L. et al., achieving the highest values when all variables were used (65.4% of accuracy). Novel parameters showed a largest discriminatory potential in predicting the implantation rate of blastocyst (63.0%), increasing by combining them with the morphological parameters (64.2%). Finally, the conventional morphokinetic variables obtained the lowest results (60.5%). In addition, it was statistically probed according to Wilcoxon rank sum test that the variables scored by each observer came from continuous distributions with equal medians in terms of the 95% confidence and significance.

CONCLUSIONS: This study confirms the discriminative capability of novel variables and their influence on models based on deep learning algorithms for the prediction of implantation potential, which is enhanced by combining them with morphological information. In addition, it is shown that these variables can be annotated by different observers without significantly affecting the model performance.

IMPACT STATEMENT: Morphology dynamics based on manual annotations of novel parameters of the growing embryo impact on increasing the prediction of blastocyst implantation potential despite interobserver variability even compared with morphokinetic annotations or blastocyst morphology obtained automatically.

Reference

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CYTOPLASMIC MORPHOLOGICAL CHARACTERISTICSAFFECT 2PN DETECTION IN AN AUTOMATIC PRONUCLEAR NUMBER DETECTION SYSTEM USING DEEP LEARNING TECHNOLOGY.

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