Machine learning-based image classification and video tracking reveal the correlation between sperm morphology and motility

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Infertility is a growing issue worldwide; one of six people experiences fertility issues. Among them, male infertility is estimated to be responsible for 50% of all cases. To deal with this, in vitro fertilization is widely used. For more successful in vitro fertilization outcomes, the selection of sperm is essential. The three key features for the evaluation of sperm functionality are sperm head morphology, motility, and DNA fragmentation. Among these, sperm head morphology is a key determinant of fertilization capacity, as abnormal head morphology often contributes to male infertility. Sperm motility is also essential, since only motile sperm can get through cervical mucus and progress toward the ampulla, acting as a natural barrier. Traditionally, these characteristics have been evaluated through manual observation by medical professionals for in vitro fertilization. However, recent advancements in computer vision and tracking have enabled the automation of sperm quality evaluation. Despite the clinical significance of the two features, sperm head morphology and motility, their correlation has been rarely studied. This study aims to investigate the interrelationship between sperm head morphology and motility using machine learning based image classification and video tracking, especially focusing on how morphological abnormalities affect motility indices. In the future, we hope this study lays the groundwork for more effective in vitro fertilization practices.