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Development estimation of human frozen-thawed blastocysts based on their oxygen consumption

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Abstract
BACKGROUND: To establish a new model for the selection of a single blastocyst that has high developmental competence, the relationship between the blastocyst and its oxygen consumption was investigated.
METHODS: Oxygen consumption of frozen-thawed human blastocysts was measured at 0, 1.5, 3, 4.5, 6, 7.5, 9, and 24 h after thawing using scanning electrochemical microscopy. On the basis of their developmental stage at 24 h, blastocysts were classified into four groups (high-potential, moderate-potential, low-potential, and degenerated). Moreover, cytochrome c oxidase activity in frozen-thawed blastocysts was examined at 0 and 24 h. The developmental competence of blastocyst which was measured its oxygen consumption was also assessed after single embryo transfer.
RESULTS: The oxygen consumption rate of blastocysts just after thawing was significantly lower than that of non-frozen blastocysts ($P < 0.05$). The oxygen consumption rate of blastocysts was significantly higher in the high-potential group than in the low-potential and the degenerated groups after 1.5 h ($P < 0.05$) and than in moderate-potential group ($P < 0.05$) at 7.5 and 9 h. Moreover, cytochrome c oxidase activity was absent in frozen-thawed blastocysts at 0 h, but was detected at 24 h. The implantation rate of blastocysts with high oxygen consumption was high compared with that of blastocysts with low oxygen consumption. However, there was no statistical difference between them.
CONCLUSIONS: The respiratory rate of frozen blastocysts after thawing was significantly less than non-cryporeserved blastocysts. Oxygen consumption of blastocysts with high developmental competence was restored earlier than that of blastocysts with low developmental competence. Results of the present study allow for the proposal of a new model for the selection of frozen-thawed blastocysts with high developmental competence based on cellular respiration activity.