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Editorial

The Importance of Polarized Light Microscopy in Assisted Reproductive Technologies

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Maturation (completion of the first meiotic division) and fertilization (completion of the second meiotic division and following events) of the human oocyte depends primarily on the metaphase spindle. In MII oocytes, metapahase spindle assists chromatid segregation, thus ensures the completion of the meiotic process [1]. The parallel arrays of microtubules that form the spindle impart birefringence property to the spindle [2]. Using this property, polarized light microscope visualizes the meiotic spindle [3]. Despite being defined on 1934 (Schmidt, 1934 as cited by [4]), polarization microscopy has been introduced to human IVF on the beginning of the 21st century [5]. Since then, various studies regarding the effect of presence [6-8], location (in relation to the first polar body) [8-11], and quantitative morphological features [12-14] of the meiotic spindle on IVF outcome have been conducted. Furthermore, studies regarding sperm selection using polarized light microscopy [15,16] and the predictive effect of light retardance of the zona pellucida on embryonic development [17,18] have also been studied.

The initial use of polarized light microscopy in IVF laboratory was offered by Wang et al. to detect the location of the meiotic spindle during ICSI procedure and perform ICSI accordingly [5], because of the evidence that the meiotic spindle may not always be located under the first polar body (PB) in mammalian oocytes [19]. They also reported that some oocytes may not have a visible spindle during ICSI and oocytes with a visible spindle have higher fertilization rate [5]. The positive effect of the presence of a visible spindle on fertilization and embryo quality was also emphasized by other researchers [6,8]. There are controversies about the effects of location [9,10] and quantitative morphological features [7,12,14,20] of the meiotic spindle, and light retardance of the zona pellucida [7,12] on fertilization rates and embryo quality.

Some of the MII oocytes (18% [6], 16.5% [8]) do not possess a visible meitotic spindle during ICSI. The visualization of the meiotic spindle during oocyte maturation has revealed some steps of spindle kinetics. After the extrusion of the first PB, the spindle is observed as a connective strand between the first PB and the ooplasm for 75-90 min (telophase I stage). After that, during a period of 40-60 min., the spindle is not observed. After this period, the MII spindle is formed [21]. The oocytes, which are detected to have no spindle may be in the 40-60min maturation step described above and according to our observations in the Center for Assisted Reproductive Technologies of Gulhane Military Medical Faculty, a visible spindle forms in some of the oocytes with no visible spindle after an incubation of 1-3 hours.

As a conclusion, the presence of the first PB is not a sufficient indicator of oocyte maturity, but presence of a visible meiotic spindle together with the presence of the first PB is an accurate indicator of oocyte maturity [22]. Oocytes with a visible spindle yield higher fertilization rate and better embriyonic development [5,6,8]. Oocytes that do not have a visible spindle during ICSI have the potential to develop a visible spindle [21]. Although the fertilization rate and embryo development status of these incubated oocytes are yet to be determined, visualization of meiotic spindle using polarized light microscopy may be useful in deciding optimal ICSI timing in both in vivo and in vitro matured human oocytes [22,23], especially for the patients with recurrent IVF failure.

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