Intrauterine Dissolved Oxygen Profiling During the Luteal Phase: A Feasibility Study in Healthy Women

Authors: *Anna Teixido Troyano,[1] Melchor Carbonell Socias,[1] Carmen Cabeza Oliver,[1] Elisabeth Sanfeliu de España,[1] Luis Manuel Artiles Martinez,[2] Monica Rodriguez de la Vega Otazo,[2] J. Herrero García[2]

1. Unit of Assisted Reproduction and Gynaecological Endocrinology, Department of Obstetrics and Gynaecology, Vall d'Hebron University Hospital, Barcelona, Spain
2. Manina MedTech S.L., Research and Development, Barcelona, Spain

*Correspondence to anna.teixido@vallhebron.cat

Disclosure: de la Vega Otazo and Artiles Martinez are founders of Manina MedTech S.L. García and Socias hold equity interests in Manina MedTech S.L. The other authors have declared no conflicts of interest.

Disclaimer: This study was promoted by Manina MedTech S.L. and conducted in collaboration with the Vall d'Hebron Research Institute (VHIR). The study was approved by the Vall d'Hebron University Hospital Ethics Committee (PR(AMI)336/2021) and conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent. The clinical trial registration number is ISRCTN85528745 (retrospectively registered).

Acknowledgements: The authors would like to thank all the study participants and the staff of the Reproductive Medicine Unit at Vall d'Hebron University Hospital, Barcelona, Spain, for their contribution to this study.

Keywords: Angiogenesis, assisted reproduction, embryo–endometrium synchrony, endometrial receptivity, intrauterine oxygen, luteal phase.

Citation: EMJ Repro Health. 2026;12[1]:40-42. https://doi.org/10.33590/emjreprohealth/AR8LR9L1

BACKGROUND AND AIMS

Assessment of endometrial receptivity remains one of the major challenges in reproductive medicine despite significant advances in embryo selection and assisted reproductive technologies. At the 2026 European Society of Human Reproduction and Embryology (ESHRE) Annual Meeting, the authors presented a feasibility study evaluating serial intrauterine dissolved oxygen measurements throughout the luteal phase in healthy women.[1]

The rationale for the study stems from experimental evidence suggesting that uterine oxygen tension varies dynamically during the peri-implantation period and may reflect underlying endometrial vascular remodelling.[2-4] While previous human studies have reported isolated intrauterine oxygen measurements, longitudinal profiling across the entire luteal phase had not previously been described. Furthermore, embryonic metabolic requirements support a physiological role for dynamic intrauterine oxygen regulation. Early embryos rely predominantly on anaerobic metabolism during cleavage stages, whereas oxygen-dependent metabolism increases substantially at the blastocyst stage. Consequently, changes in intrauterine oxygen availability during the luteal phase may align with the changing metabolic demands of the developing embryo.[5]

MATERIALS AND METHODS

In this prospective observational pilot study, eight healthy women aged 18–35 years with regular menstrual cycles underwent serial intrauterine dissolved oxygen (pO_2) measurements during a natural menstrual cycle. Measurements were performed from luteinising hormone (LH) surge LH+1 to LH+13/14 using a fibre-optic microsensor positioned approximately 1 cm from the uterine fundus under ultrasound guidance. The primary objective was to evaluate the feasibility of repeated intrauterine oxygen assessment and to characterise temporal oxygenation patterns across the luteal phase.

RESULTS

The investigators successfully obtained serial measurements in all participants and identified two distinct oxygenation profiles. Four participants demonstrated

a characteristic 'peak' pattern, with low oxygen tension during the early luteal phase followed by a marked increase between LH+4 and LH+6, reaching values of approximately 40–45 Torr before declining after LH+8. One of these participants exhibited a similar but temporally advanced peak. In contrast, four participants maintained relatively low oxygen levels throughout the luteal phase without a discernible mid-luteal rise, constituting a 'no-peak' pattern. The two distinct oxygenation patterns observed across the luteal phase are illustrated in Figure 1.

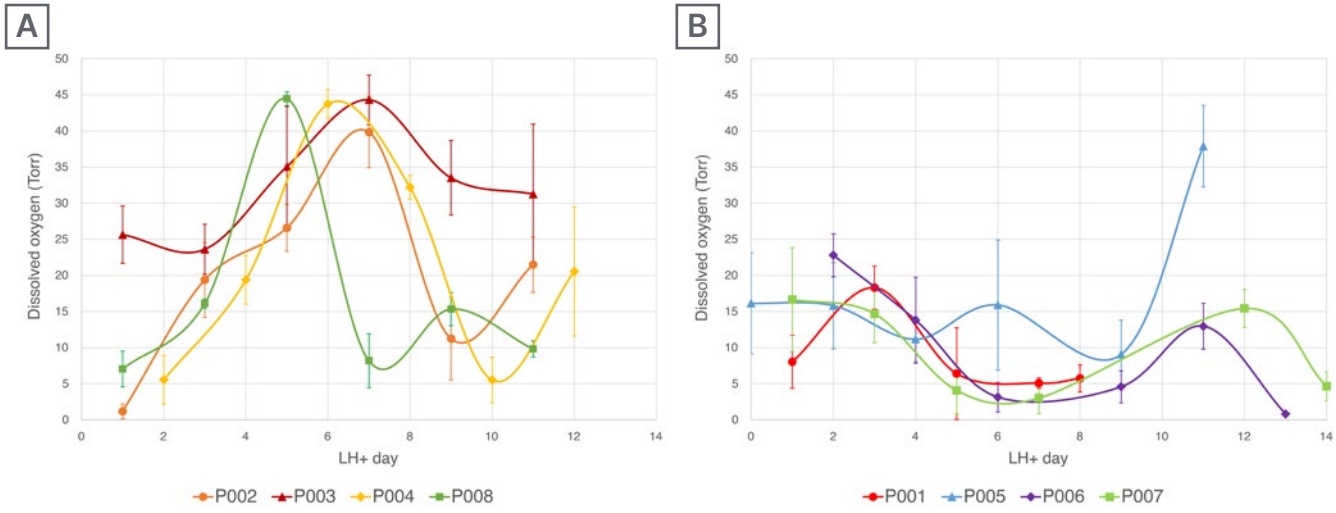
Post-hoc review identified potential physiological, pharmacological, or lifestyle-related factors among participants exhibiting the no-peak profile. Although causal relationships cannot be established from this small pilot cohort, these observations raise the possibility that intrauterine oxygen dynamics may be sensitive to factors influencing endometrial maturation and function.

Importantly, the procedure was well tolerated, with reported pain scores ranging from 0–2 on a visual analogue scale and no procedure-related adverse events. These findings support the technical feasibility and acceptability of serial intrauterine oxygen monitoring.

CONCLUSION

The study introduces a novel concept: the use of real-time intrauterine oxygen profiling as a functional biomarker of endometrial status. Unlike molecular or histological approaches, oxygen assessment provides an immediate physiological measurement obtained within the same menstrual cycle. If validated in larger studies and infertility populations, this approach could offer a

Figure 1: Representative intrauterine dissolved oxygen profiles during the human luteal phase.



Temporal profiles of intrauterine dissolved oxygen concentration (pO_2, Torr) across the luteal phase. The x-axis represents days relative to the luteinising hormone surge (LH+ days), ranging from LH+0 to LH+14, and the y-axis shows intrauterine oxygen levels (0–50 Torr). Each coloured line represents an individual participant, with mean pO_2 values and error bars indicating standard deviations at each time point. pO_2 values represent averages obtained from a 5-minute continuous recording period at each time point. Participants are categorised into two distinct response patterns:

A) Peak pattern: characterised by a mid-luteal rise in O_2 concentration (participants P002, P003, P004, and P008).
B) No-peak pattern: characterised by consistently low or stable pO_2 levels throughout the luteal phase (participants P001, P005, P006, and P007).

LH: luteinising hormone.

minimally invasive method for evaluating embryo–endometrium synchrony and potentially refining embryo transfer timing.

Although limited by its small sample size and exploratory design, this work represents the first *in vivo* characterisation of dynamic intrauterine oxygen changes across the luteal phase in women and provides a foundation for future studies evaluating intrauterine oxygen profiling as a potential same-cycle functional biomarker of embryo–endometrium synchrony and endometrial receptivity.

References

1. Teixidó Troyano A et al. Intrauterine dissolved oxygen profiling during the luteal phase: a feasibility study in healthy women. Abstract L26/P-554. ESHRE Annual Meeting, 5-8 July, 2026.
2. Mitchell JA, Yochim JM. Intrauterine oxygen tension during the estrous cycle in the rat: its relation to uterine respiration and vascular activity. Endocrinology. 1968;83:701-5.
3. Garris DR, Mitchell JA. Intrauterine oxygen tension during the estrous cycle in the guinea pig: its relation to uterine blood volume and plasma estrogen and progesterone levels. Biol Reprod. 1979;21:149-59.
4. Ottosen LDM et al. Observations on intrauterine oxygen tension measured by fibre-optic microsensors. Reprod Biomed Online. 2006;13:380-5.
5. Gardner DK, Harvey AJ. Blastocyst metabolism. Reprod Fertil Dev. 2015;27:638-54.