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Comparing the Manual Technique Reports and PRIME SPERM CASA Reports for Sperm Motility – The Systematic Review

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Abstract

This study aims to compare the accuracy, consistency, and clinical relevance of sperm motility assessments obtained through manual microscopic evaluation with those generated by the Computer-Assisted Semen Analysis (CASA) system, specifically the PRIME SPERM CASA. Sperm motility is a critical parameter in male fertility assessment, and traditional manual techniques often suffer from subjectivity and inter-observer variability. In contrast, CASA systems offer objective, reproducible results through automated analysis. A cohort of semen samples was analyzed using both methods, and the results were evaluated in terms of total motility, progressive motility, and non-progressive motility. The study found that while the manual technique remains a widely used and accessible method, PRIME SPERM CASA provides more precise and consistent measurements. The findings highlight the advantages of integrating CASA technology in clinical and research settings to enhance the accuracy of semen analysis, particularly for diagnostic and treatment planning purposes in male infertility.

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Introduction

Sperm motility is a fundamental parameter in the evaluation of male fertility, playing a crucial role in the ability of sperm to reach and fertilize the ovum. Accurate assessment of sperm motility is therefore essential in both clinical diagnostics and reproductive research (WHO, 2021; Cooper *et al.,* 2010; Björndahl *et al.,* 2003).

Traditionally, sperm motility has been assessed using manual microscopic techniques, where trained technicians visually classify sperm movement based on WHO guidelines (Keel, 2004; Zavos *et al.,* 2013; Talarczyk-Desole *et al.,* 2020; Blanchard *et al.,* 2011). While widely adopted and cost-effective, manual analysis is subject to inter-observer variability, operator fatigue, and limited reproducibility, which can affect the reliability of the results.

In recent years, advances in automated systems such as Computer-Assisted Semen Analysis (CASA) have transformed the approach to semen evaluation. CASA systems, including the PRIME SPERM CASA, utilize high-resolution imaging and advanced algorithms to objectively measure motility parameters such as total

motility, progressive motility, and velocity (Amann and Waberski, 2014; Eliasson, 1984; Barratt *et al.,* 2017). These systems reduce human error and offer consistent, reproducible, and quantifiable data, which are particularly valuable in high-throughput clinical settings (Dearing *et al.,* 2021; Singh *et al.,* 2011). Despite the growing adoption of CASA technologies, many laboratories still rely on manual techniques, either due to cost constraints or as a standard practice (Dearing *et al.,* 2014). This study aims to compare the outcomes of manual sperm motility assessment with those obtained using the PRIME SPERM CASA system.

Sperm motility refers to the ability of sperm cells to move actively and efficiently, a critical factor in determining male fertility (Zhou *et al.,* 2021; Jung and Cho, 2019; Agarwal *et al.,* 2019). The World Health Organization (WHO) classifies motility into progressive motility (PR), non-progressive motility (NP), and immotile sperm (IM). A normal semen analysis, according to WHO standards, requires at least 40% total motility or 32% progressive motility. Accurately assessing these values is vital for diagnosing male infertility and guiding treatment decisions (Brito *et al.,* 2016; Komori *et al.,* 2006; Freour *et al.,* 2009).

Two main approaches exist for assessing sperm motility:

Manual Microscopy, which involves a technician observing and estimating motility under a microscope.

Computer-Assisted Semen Analysis (CASA), an automated technique that uses software to track and analyze sperm movement based on image capture and motion analysis.

The PRIME SPERM CASA system is a modern CASA solution designed to provide precise, reproducible, and objective semen analysis, including motility metrics.

Materials and Methods

Sample Collection and Preparation

Semen samples were collected from a cohort of males attending a fertility clinic. Following collection, each sample was allowed to liquefy at room temperature for 30 minutes. Subsequently, the sample was divided into two aliquots: one designated for manual evaluation, and the other for computer-assisted semen analysis (CASA) using the PRIME SPERM system (Knuth and Nieschlag, 1988; Jędrzejczak *et al.,* 2005; Auger *et al.,* 2016).

Manual Technique

- Performed by trained technicians using phase-contrast microscopy at 400x magnification.
- At least 200 spermatozoa were assessed per sample.
- Motility was categorized into:
  - Progressive motility (PR)
  - Non-progressive motility (NP)
  - Immotile sperm (IM)
- Subjective judgment and technician experience played a key role in the assessment.

PRIME SPERM CASA

- The PRIME SPERM CASA system recorded video footage and automatically tracked the trajectory, velocity, and pattern of sperm movement.
- The system calculated:
  - Total motility (%)
  - Progressive motility (%)
  - Curvilinear velocity (VCL)
  - Straight-line velocity (VSL)
  - Linearity (LIN) and amplitude of lateral head displacement (ALH)
- Each analysis was completed within a few minutes, with data stored electronically for consistency and review.

Results and Discussion

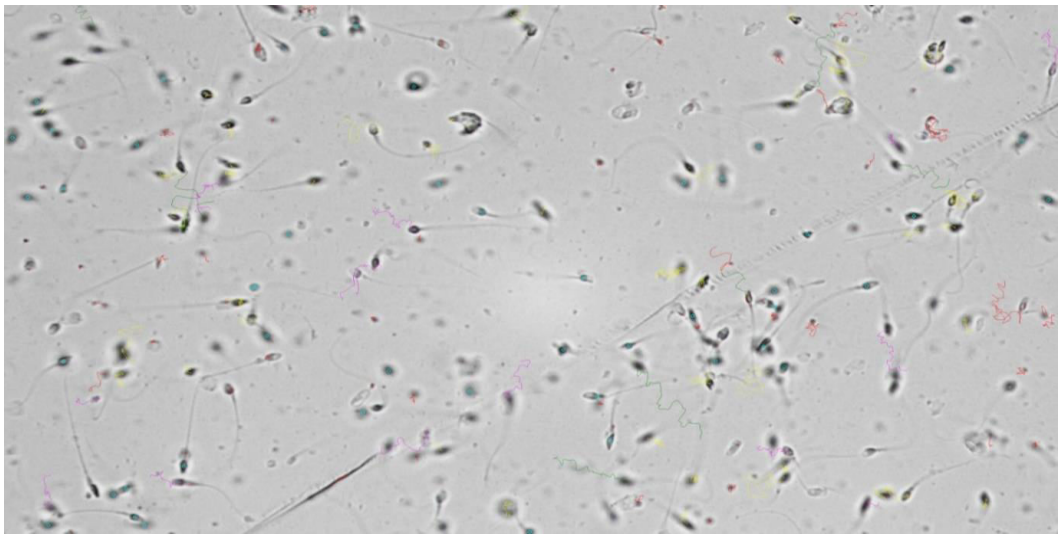
The comparative study reveals that while the manual technique remains a standard method in many clinics, it is inherently subjective and influenced by the skill and attentiveness of the technician. Manual analysis is prone to fatigue-related errors and shows notable inter- and intra-observer variability.

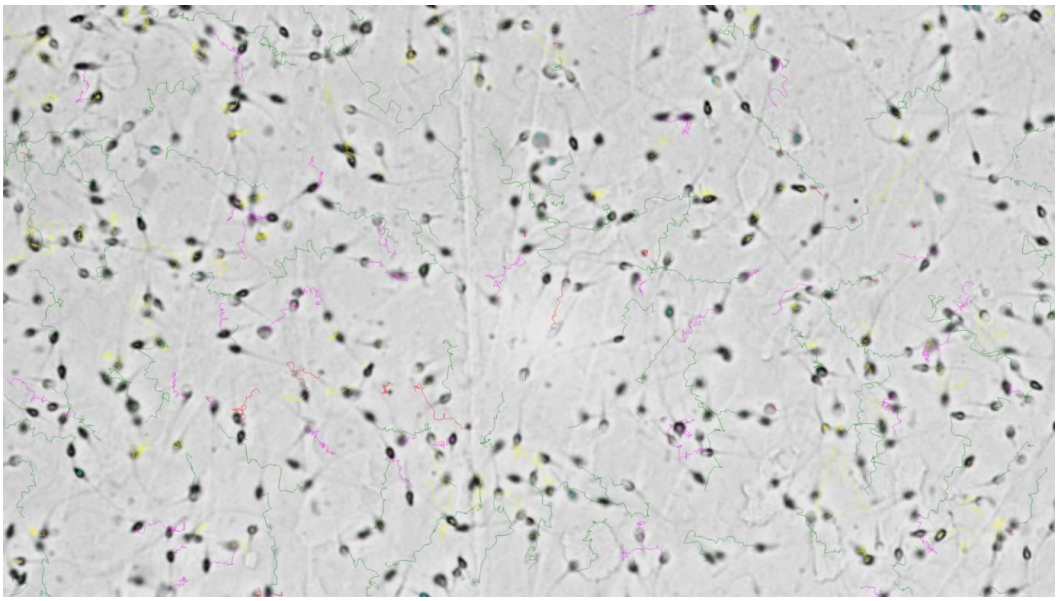
On the other hand, the PRIME SPERM CASA system demonstrates clear advantages in terms of precision, speed, and reproducibility. CASA systems eliminate much of the human error and provide consistent results across different users and laboratories. Moreover, CASA offers detailed kinetic parameters (like VCL, VSL, and LIN), which are not possible with manual assessment, allowing for a deeper understanding of sperm functionality.

Table.1

Parameter	Manual Technique	PRIME SPERM CASA	Observations
Total Motility	Slightly overestimated in many cases	Objective and consistent	CASA showed less variability
Progressive Motility	Often underestimated due to fatigue or visual error	Accurately measured with trajectory analysis	CASA provided clearer cut-off values
Non-Progressive Motility	Vague classification by technicians	Quantified precisely	CASA differentiated between NP and PR better
Reproducibility	Low (subject to inter-observer variability)	High (automated and consistent)	CASA had superior repeatability
Time Taken	10–15 minutes per sample	2–5 minutes per sample	CASA was faster overall
Data Output	Manual record	Digital, graphical, and statistical	CASA offered in-depth motility profiles

Figure.1 Motility Images of PRIME SPERM CASA





However, CASA systems are more expensive, require initial calibration and maintenance, and may not be accessible in resource-limited settings. In such cases, manual analysis remains a viable alternative if performed by well-trained personnel under standardized conditions.

Conclusion

The assessment of sperm motility is a cornerstone of male fertility evaluation, and the choice of methodology significantly influences the accuracy and reliability of the results.

This study demonstrates that while manual semen analysis remains a widely practiced and accessible technique, it is limited by subjectivity, inter-observer variability, and reduced reproducibility. In contrast, the PRIME SPERM CASA system offers a more advanced, objective, and efficient approach to motility evaluation.

The PRIME SPERM CASA consistently provided precise quantification of sperm motility parameters, including progressive and non-progressive motility, with minimal operator bias and high reproducibility. Additionally, its ability to generate detailed kinetic data enhances the diagnostic value of semen analysis, particularly in borderline or complex cases.

Despite higher initial costs and equipment requirements, CASA systems such as PRIME SPERM present a significant improvement over manual methods in terms of both quality and efficiency. Therefore, integrating CASA technology into routine laboratory practice can greatly enhance the reliability of male fertility diagnostics and support better clinical decision-making.

In conclusion, while manual techniques still have relevance, particularly in settings with limited resources, PRIME SPERM CASA represents a superior alternative for laboratories seeking accuracy, standardization, and comprehensive motility assessment.

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