The Importance of the Sperm Motility Classes - Future Directions

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Abstract: The 2010 WHO Laboratory Manual for the Examination and Processing of Human Semen has established a new classification of sperm motility, as follows:

a) progressive motility, which includes both forward progression (rapid and slow) and sluggish motility;

b) non progressive motility.

Unfortunately, this new classification is insufficient to allow for detailed evaluation of the sperm kinetic properties seen in clinical practice, especially with regard to forward motility.

Computer Aided Sperm Analysis Systems are still not available in all andrology laboratories, even though 20 years have passed since their introduction.

Therefore, our group has created a dedicated software, the Superimposed Image Analysis System, which superimposes a sequence of images on a monitor, producing a final image with a motion effect.

This system allows for the objective evaluation of the tracks described by spermatozoa and can subdivide sperm into four motility classes based on straight-line velocity, curvilinear velocity and linearity values.

Keywords: Sperm motility, CASA systems, superimposed image analysis system, human semen analysis

THE IMPORTANCE OF SPERM MOTILITY CLASSES - FUTURE DIRECTIONS

Semen analysis is an essential tool in the study of male fertility and is extremely useful in monitoring spermatogenesis during and following male fertility regulation. The 5th edition of the WHO Laboratory Manual for the Examination and Processing of Human Semen, published in 2010 [1], has introduced some significant variations in the standardization of human semen processing compared with the previous editions. The new guidelines have classified sperm motility under two categories only:

a) progressive motility (PR);

b) non progressive motility (NP).

These 2 categories now substitute the previous "a", "b" and "c" classes found in the WHO Manual of 1999 [2]. This latest edition has added to the already existing problem of the 4th edition [2] regarding grade "b" motility, which included both slow progressive and sluggish movement.

In the new edition, "Total motility" (PR+NP) (normal ≥40%), includes both rapid and slow progressive motility, sluggish motility and non progressive motility; and "Progressive motility" (PR) (normal ≥32%), includes both rapid, slow progressive and sluggish motility in the same class.

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The reason given for this choice is reported in Comment 1 (p 22 of the 5th Edition [1]: "It is difficult for technicians to define the forward progression so accurately without bias" [3].

However, difficulties cannot be overcome simply by avoidance; rather, they need to be faced up to and solved.

In the literature, many studies have underlined the importance of sperm motility evaluation, in particular forward motility, in order to define fertilizing capacity, to evaluate the possible effects of medical and/or surgical treatments and, finally, to study the follow up of kinetic parameters in subjects affected by andrological pathologies.

These observations were also made in the latest Special Issue (volume 12, 2010) of the Asian Journal of Andrology. Björndahl stated that effective passage of spermatozoa through cervical mucus depends on rapid progressive motility (at least 25 μm/sec) [4]. Eliasson stated that ignoring the speed of progressive motility is like ignoring a very important prognostic fertility factor. Furthermore, a method that disregards the quality of progressive motility cannot be considered suitable for studies related to fertility or to the effects of exogenous factors on sperm motility [5].

In recent years, many attempts have been made to establish the objective assessment of sperm motility. Many laboratories have adopted digitalized Computer Aided Sperm Analysis (CASA) Systems. However, these systems still suffer from technical limits in certain situations, such as reading cases of oligozoospermia or cases with a high percentage of non-sperm cells in the semen [6]. In addition,

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they require continuous set up and are rather expensive. For all these reasons, such digital systems are still not available in all andrology laboratories, even though 20 years have passed since their introduction [7].

The alternative visual methods (time-exposure photomicrography, videomicrography, etc.) have other drawbacks; they are slow and laborious, and the frame/rates are sometimes inadequate for the tasks required.

In an attempt to combine the accuracy of visual reading with the velocity of computerized systems, we developed the Superimposed Image Analysis System (SIAS)[8]. This software superimposes a sequence of images on a monitor, producing a final image with a motion effect (21 frames/sec). It allows for the objective evaluation of the tracks described by spermatozoa and a subdivision of these into four motility classes using straight-line velocity (VSL), curvilinear velocity (VCL) and Linearity (LIN) values. Continuous visual checking of the real sperm movement avoids any difficulties of interpretation. An added advantage of this system is that it is well within the budgets of most laboratories in the world.

Using SIAS, we made an attempt to define VSL, VCL and LIN numerically in each sperm motility class we took into consideration:

Class 1 (straight-line progressive): VSL ≥23μm/sec and LIN ≥0.58;

Class 2 (straight slow progressive): VSL >10 μm/sec and <23 μm/sec and LIN ≥0.58;

Class 3: VSL >10 μm/sec and LIN <0.58 (this additional class was added to differentiate nonstraight progressive motility from classes 1 and 2);

Class 4 (non progressive): VSL ≤10 μm/sec.

Naturally, the classes presented here are only a proposal, which could be integrated with or substituted by others; the important point is that helpful solutions should be offered rather than avoidance of the issue.

In conclusion, the distinction between sperm motility classes (rapid and slow progressive motility, sluggish and non progressive motility) is one of the essential parameters in the evaluation of fertilizing ability; to ignore a part of this crucial information risks compromising the clinical use of semen analysis.

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