Validation Report – AndroVision® Automorph

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AndroVision® is widely used in semen production labs for the precise and objective evaluation of motility and sperm concentration.

With AndroVision® Automorph, proximal and distal droplets as well as highly bent tails are detected automatically, allowing a full semen analysis including motility, sperm concentration and morphological evaluation in less than one minute. The aim of this study was to compare the results of the automated morphological analysis of boar semen performed by AndroVision® Automorph with the results obtained by an expert, who evaluated the images recorded from AndroVision® manually.

AndroVision® Automorph was equipped with a 10x negative phase contrast objective and a 1.0x camera adapter on a Zeiss microscope. Together with the measurement of sperm concentration and motility, the morphology of sperm cells was examined in a 20 µm Leja counting chamber. To identify all motile sperm cells as potential droplet carriers, the morphological analysis was performed on each of the 30 frames recorded per analysis. In this trial, 67 boar ejaculates were analysed with AndroVision® Automorph with a total number of 7405 sperm cells. As a reference to validate results from the automated morphology examination, trained andrology lab personnel manually counted the sperm cells recorded using AndroVision® and evaluated the morphological status of each spermatozoon. The morphological evaluations focused on proximal droplets, distal droplets and bent tails (Figure 1).
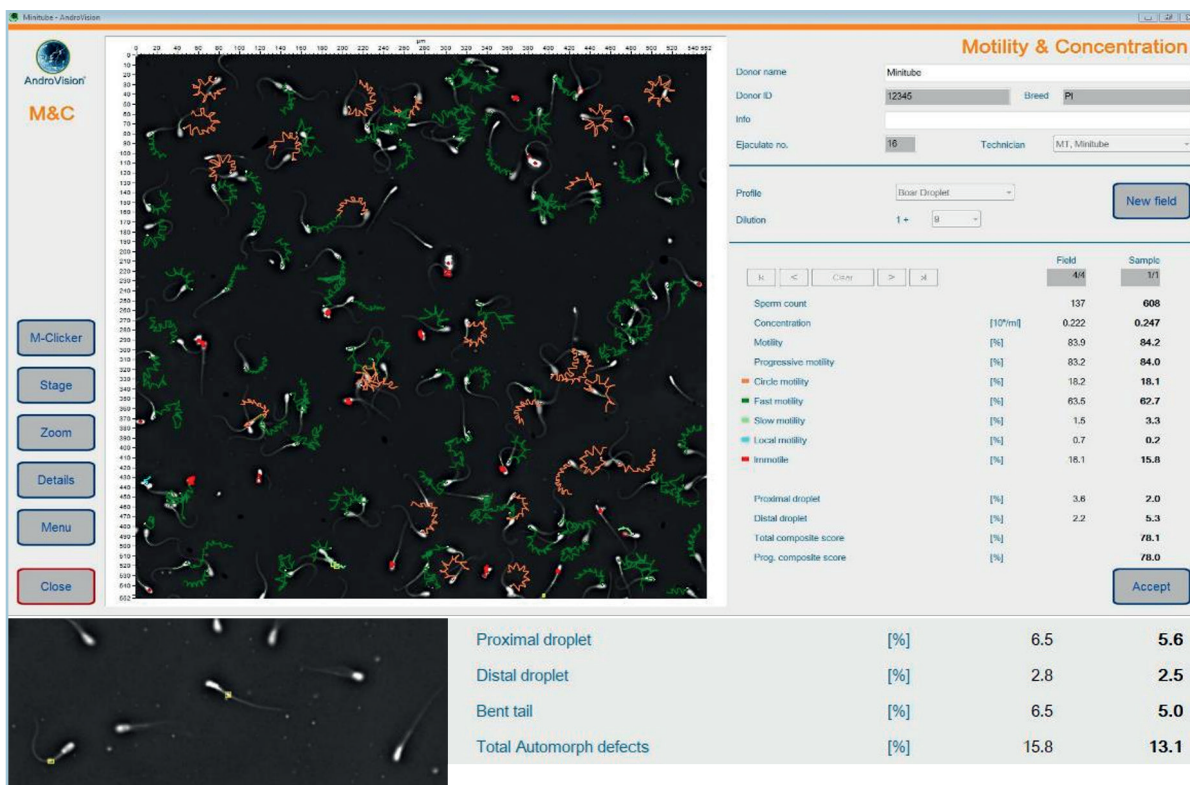

Figure 1: Screenshot of AndroVision® analysis report including motility, concentration and morphological evaluation

I: Results of the single cell validation

Evaluation of the AndroVision® Automorph results on a per cell basis revealed, that the automated analysis correctly identified 95% of the morphologically abnormal sperm cells and 98% of the morphologically normal sperm cells.

	AV Automorph: morphologically abnormal cells	AV Automorph: morphologically normal cells	Total
Expert classification: morphologically abnormal cells	1026	49	1075
Expert classification: morphologically normal cells	126	6204	6330
Total	1152	6253	7405

Sensitivity	95%	(1026/1075)
Specificity	98%	(6204/6330)
Positive predictive value	89%	(1026/1152)
Negative predictive value	99%	(6204/6253)

Table 1: Overall conformity between AndoVision® Automorph and expert analysis on a single cell basis comparison

II: Results of the ejaculate analysis validation

Ejaculates were classified according to the proportion of morphologically abnormal sperm cells to the total number of analysed sperm cells. If the percentage of sperm cells with proximal and distal droplets and bent tails exceeded 20%, the ejaculate was classified as not acceptable.

	AV Automorph: > 20% morphologically abnormal cells	AV Automorph: ≤ 20% morphologically abnormal cells	Total
Expert classification: morphologically abnormal cells > 20%	15	0	15
Expert classification: morphologically abnormal cells ≤ 20%	1	51	52
Total	16	51	67

Sensitivity	100%	(15/15)
Specificity	98%	(51/52)
Positive predictive value	93.8%	(15/16)
Negative predictive value	100%	(51/51)

Table 2: Overall conformity between AndroVision® (AV) Automorph and expert classification on an ejaculate basis comparison

minitube

When applying a threshold of 20% morphologically abnormal sperm cells per sample as the maximum acceptable level, AndroVision® Automorph correctly detected all of the ejaculates, which had more than 20% abnormal cells according to the manual classification of an expert.

93.8% of the samples detected by AndroVision® Automorph as morphologically not acceptable were confirmed by the manual counting. This means that only one sample out of 16 classified by AndroVision® as unacceptable was not confirmed by manual classification.

Quality criteria of porcine semen doses regarding morphological abnormalities often include, that the occurrence of each defect analysed should not exceed 15%, independent of the total percentage of defects. Individual validation of distal and proximal droplets as well as bent tails showed, that 98.5%, 97% and 98.5% of the samples identified as acceptable were confirmed by the manual classification, respectively (Figure 2).
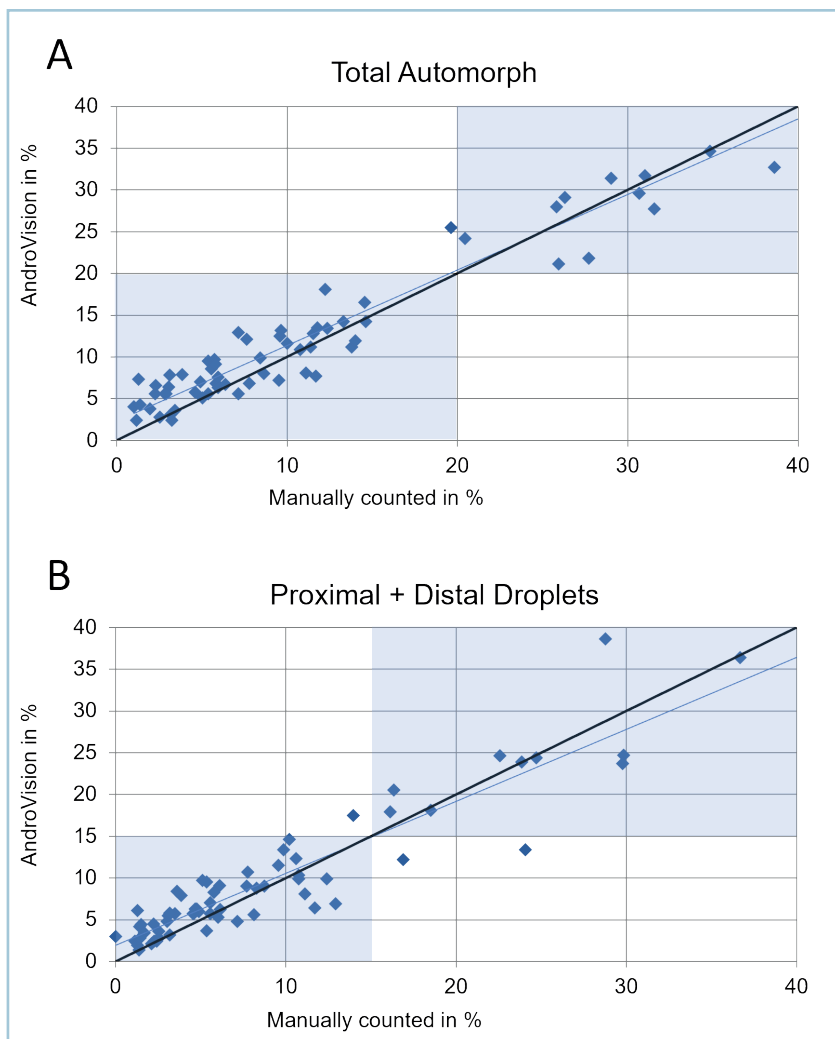

Figure 2: Classification of ejaculates according to the total morphological abnormalities (A: Total Automorph) and for proximal and distal droplets only (B)

Conclusion

AndroVision® Automorph provides a very effective and easy-to-use quality control tool for the analysis of boar semen, identifying every ejaculate with critical morphology problems in this study, while erroneously only discarding one out of 16.
Morphology screening of all collected ejaculates prior to production and distribution will help to optimize boar management, improve the quality of the produced semen doses and support reproductive performance of sow farms.