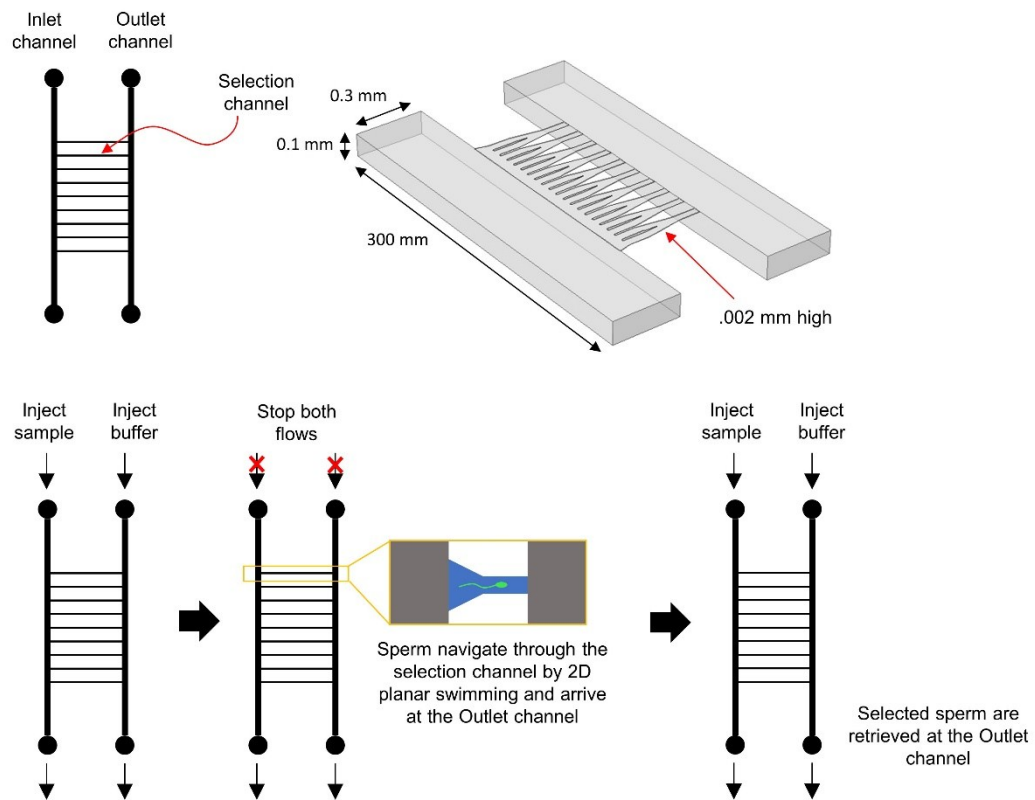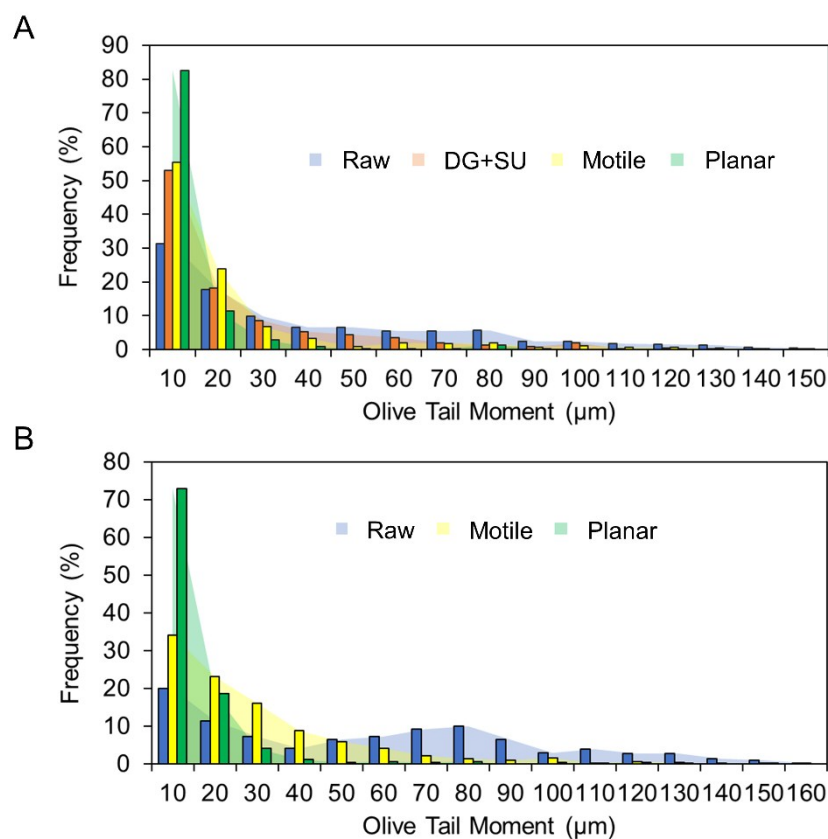# Electronic Supplementary Information

Two-Dimensional Planar Swimming Selects for High DNA Integrity Sperm

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Fig. S1 Schematic demonstrating loading, selection and collection in the device.

**Fig. S2** Average olive tail moment distribution of donor and clinical patient semen samples. A) In donor samples 28% of raw sperm showed < 10 μm olive tail moment, while this ratio increased to 50% for the motile sperm and to 99% for the planar swimming sperm. B) In patient samples, 30% of the raw sperm exhibited < 10 μm olive tail moment. This ratio increased to 64% for the motile sperm and 98% for the planar swimming sperm.
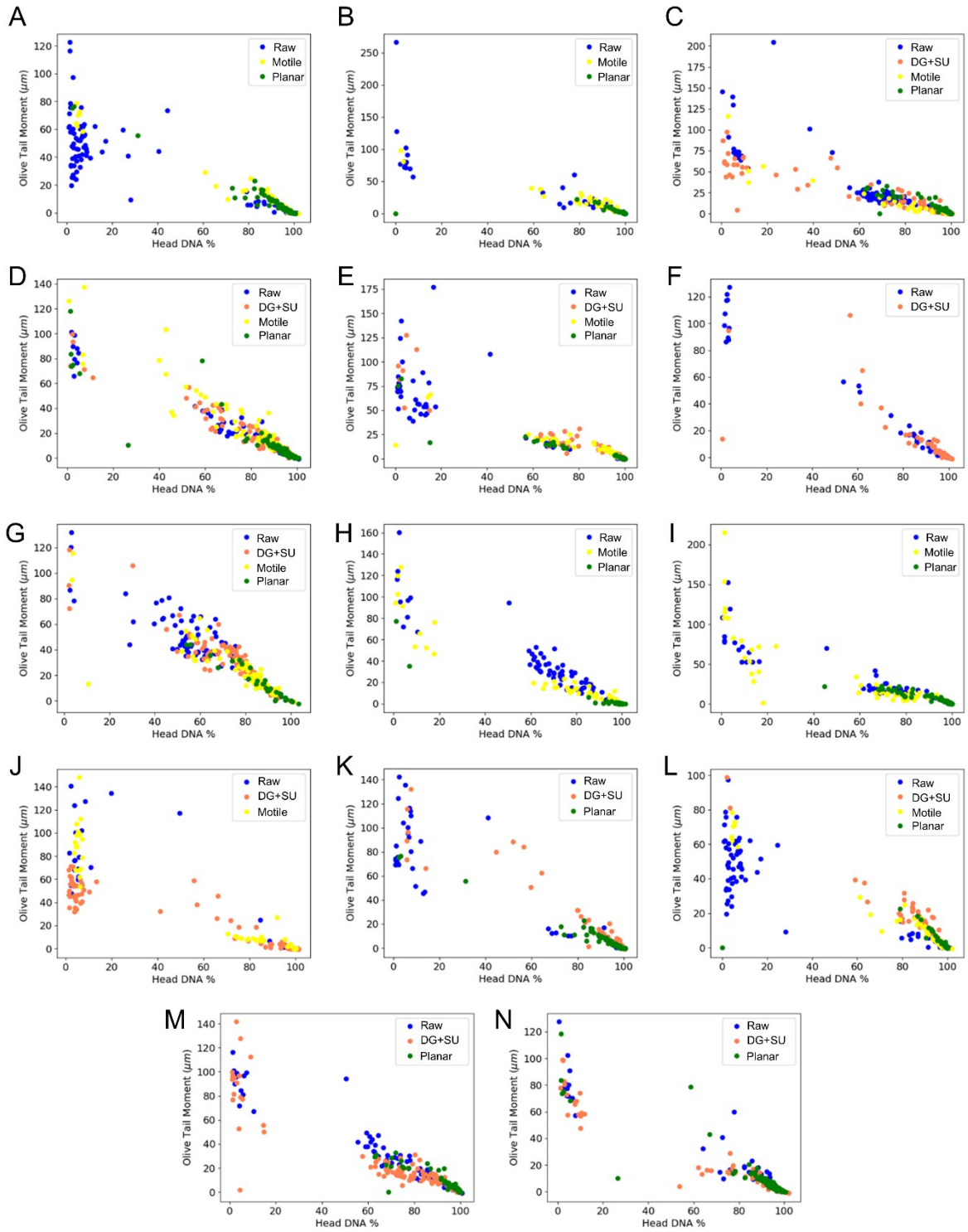
Fig. S3 Head DNA % and olive tail moment scatter plot of each donor semen sample following single-cell gel electrophoresis.
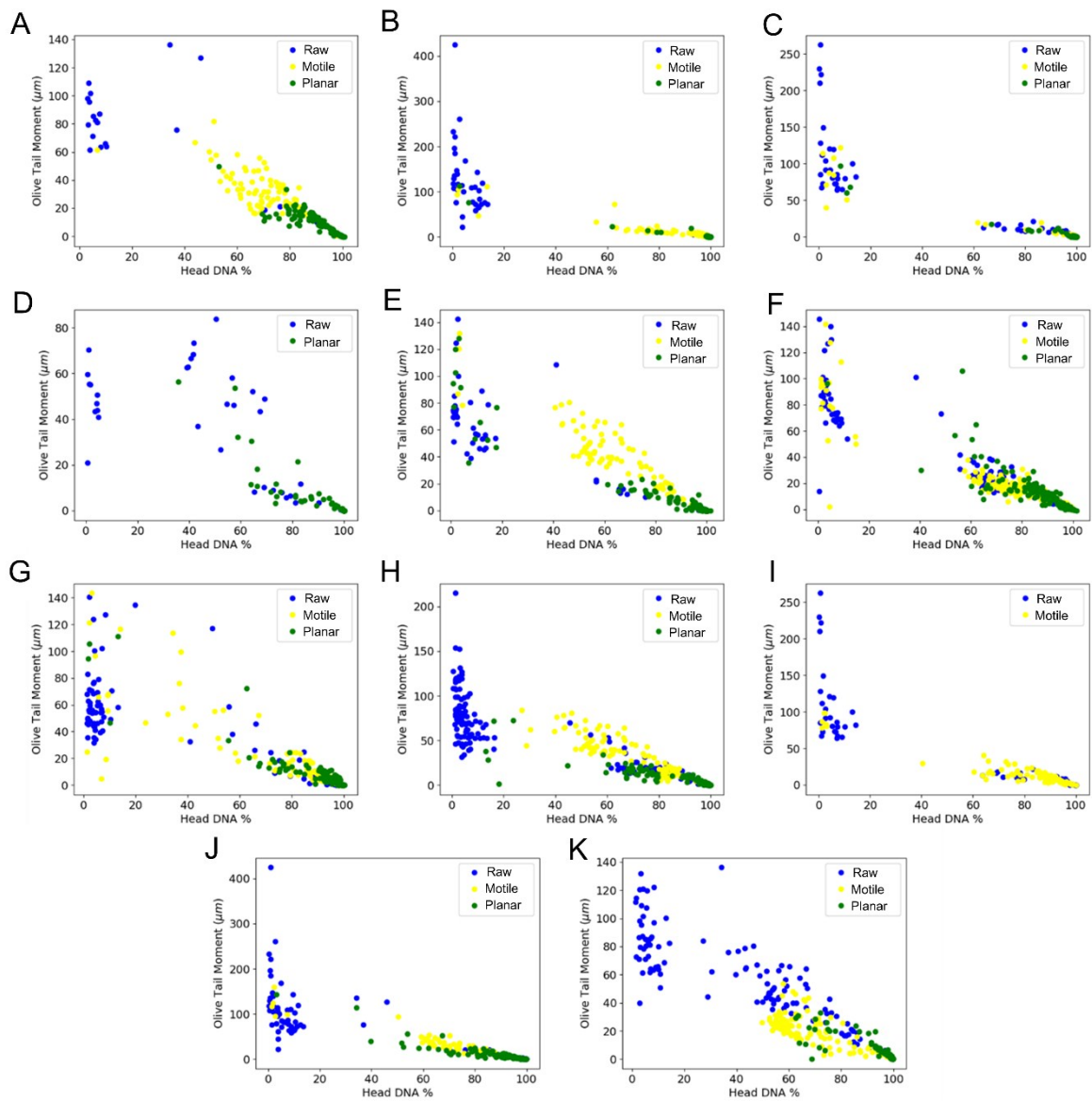
Fig. S4 Head DNA % and olive tail moment scatter plots of each patient semen sample following single-cell gel electrophoresis.
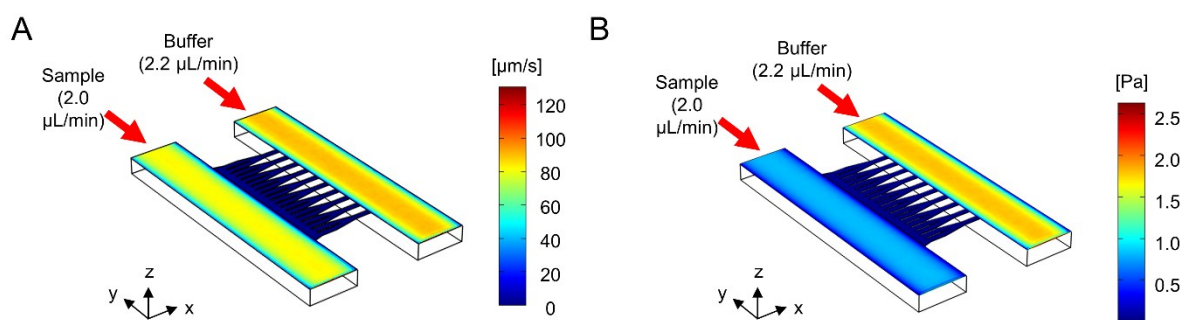
Fig. S5 Numerical simulation of velocity distribution (A) and shear stress distribution (B) in the device during loading and collection processes, within a plane that crosses the selection channels at mid-height.

Table S1. Detailed comet measurements for both donor and patient samples. Values are presented as average ± S.D.

	Donor			Patient		
	Head DNA (%)	**OTM (μm)**	**Tail Moment (μm)**	**Head DNA (%)**	**OTM (μm)**	**Tail Moment (μm)**
Raw (range)	59.5 ± 10.0 (40.5 – 77.5)	35.8 ± 6.9 (20.5 – 46.2)	72.8 ± 19.1 (35.5 – 118.8)	40.8 ± 7.5 (24.9 – 49.1)	58.0 ± 18.8 (34.6 – 99.6)	122.1 ± 31.2 (72.0 – 186.0)
DG+SU (range)	79.7 ± 5.5 (69.1 – 87.6)	18.1 ± 5.1 (13.0 – 31.3)	29.8 ± 11.5 (14.5 – 52.1)	Data not available		
Motile (range)	81.1 ± 5.0 (70.0 – 87.7)	16.5 ± 4.9 (9.9 – 23.8)	28.6 ± 12.7 (11.3 – 49.1)	73.2 ± 6.5 (62.2 – 82.7)	25.4 ± 9.6 (15.2 – 43.0)	47.4 ± 18.5 (26.3 – 82.0)
Planar (range)	92.5 ± 2.5 (90.0 – 97.5)	6.5 ± 2.7 (2.0 – 10.2)	7.7 ± 3.3 (1.8 – 11.2)	90.4 ± 2.3 (87.5 – 95.3)	7.8 ± 2.2 (4.3 – 11.0)	11.1 ± 2.6 (8.7 – 18.0)

Table S2. Sperm concentration and motile concentration of the anonymized donor semen samples used in this study

Donor #	Sperm concentration $(10^6 \times mL^{-1})$	Motile concentration $(10^6 \times mL^{-1})$
1	75	25
2	72	26
3	104	31
4	58	16
5	68	20
6	74	21
7	116	45
8	105	37
9	111	40
10	114	55
11	118	61
12	94	52
13	97	36
14	95	42
15	51	32
16	166	91

Table S3. Sperm concentration and motile concentration of the anonymized patient semen samples used in this study

Patient #	Sperm concentration $(10^6 \times mL^{-1})$	Motile concentration $(10^6 \times mL^{-1})$
1	45	19
2	72	25
3	101	31
4	69	29
5	74	23
6	85	26
7	55	35
8	112	54
9	91	12
10	63	16
11	58	11

Movie S1 Planar swimming sperm selection process. Sperm must employ a planar swimming mode through the selection channel to reach the outlet channel (right). Once in the selection channel, geometrical confinement mandates planar swimming. The movie is sped up 5x.