510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY

A. 510(k) Number:
k100341

B. Purpose for Submission:
New Device

C. Measurand:
Sperm concentration

D. Type of Test:
A one-step, immuno-chromatographic assay

E. Applicant:
Princeton BioMeditech Corporation

F. Proprietary and Established Names:
SpermCheck® Fertility

G. Regulatory Information:

1. Regulation section:
   No regulation
2. Classification:
   Class II
3. Product code:
   MNA
4. Panel:
   Obstetrics and Gynecology (85)

H. Intended Use:

1. Intended use(s):
   SpermCheck® Fertility is a qualitative test that detects sperm concentration at or above 20,000,000 sperm/mL. The test is intended for use as an aid in the determination of a man's fertility status.
   For in vitro, over the counter home use.
2. Indication(s) for use:
   Same as Intended Use
3. Special conditions for use statement(s):
   N/A
4. Special instrument requirements:
   N/A

I. Device Description:

The SpermCheck® Fertility test is a rapid qualitative test detecting the presence of sperm in human semen at 20,000,000 sperm/mL or above. A positive result on this test strip indicates a sperm concentration greater than or equal to 20 million sperm/mL, the current World Health Organization (WHO) reference value of a fertile sperm count, for a normal semen analysis.
The device includes the following supplies:

- SpermCheck® Device
- Semen Collection Cup
- Semen Transfer Device

- SpermCheck® Solution Bottle
- SpermCheck® Fertility test package insert

J. Substantial Equivalence Information:

1. Predicate device name(s):
   a. Hemacytometer
   b. SpermCheck® Vasectomy
   c. Fertell Male Fertility Test
   d. FertilMARQ™ Home Diagnostic Screening Test
2. Predicate 510(k) number(s):
   a. N/A
   b. k073039
   c. k041039
   d. k011679
3. Comparison with predicate:

Similarities		
Item	Device	Predicate
Test Type	Qualitative	SpermCheck: Same Fertell: Same FertilMARQ: Same
Intended Use	Screening of male fertility	Fertell: Same FertilMARQ: Same
Sample Type	Human Semen	Hemacytometer: Same SpermCheck: Same Fertell: Same FertilMARQ: Same
Assay Design	Chromatographic immunoassay	SpermCheck: Same Fertell: Same
Assay Principle	Colored label bound to sperm	SpermCheck: Same Fertell: Same FertilMARQ: Same
Test Temperature	Ambient temperature	Hemacytometer: Same SpermCheck: Same FertilMARQ: Same
Result Reading	Qualitative by visual line	SpermCheck: Same Fertell: Same
Detection (Positive) Level	≥20 million sperm/mL	FertilMARQ: Same

Differences		
Item	Device	Predicate
Test Type	Qualitative	Hemacytometer: Quantitative
Intended Use	Screening of male fertility	Hemacytometer: Quantitation of sperm number SpermCheck: Detects low concentrations of sperm in human semen as an aid for vasectomized men
Assay Design	Chromatographic immunoassay	Hemacytometer: Counting FertilMARQ: Chemical reaction
Assay Principle	Colored label bound to sperm	Hemacytometer: Counting
Test Temperature	Ambient temperature	Fertell: 37◦C
Result Reading	Qualitative by visual line	Hemacytometer: Counting FertilMARQ: Qualitative by visual color
Detection (Positive) Level	≥20 million sperm/mL	Hemacytometer: Any number SpermCheck: ≥250,000 sperm/mL Fertell: ≥10 million motile sperm/mL

K. Standard/Guidance Document Referenced (if applicable):

WHO Laboratory Manual for the Examination of Human Semen and Sperm-Cervical Mucus Interaction, Fourth Ed., Cambridge University Press, Cambridge, U.K.

L. Test Principle:

SpermCheck® Fertility test is a rapid qualitative test detecting the presence of sperm in human semen at 20,000,000 sperm/mL and above. The test employs solid-phase chromatographic immunoassay technology and sperm are detected using antibodies against sperm acrosome-specific protein analyte SP10. This protein is a post meiotic gene product expressed selectively in spermatids. In the test procedure, a semen sample mixed with a test solution is dispensed into the sample well, the sample migrates into the pads containing lyophilized detector antibody that is conjugated to gold dye. If the sample contains sperm, upon hydration by the applied sample, complexes are formed consisting of antibody-dye + antigen (SP10). The complexes and excess hydrated antibodies migrate forward via capillary action on the nitrocellulose membrane. The membrane serves as a solid support upon which capture antibody (test band) and anti-species IgG antibodies (control band) are immobilized. The immobilization of these reagents on the nitrocellulose membrane,

in defined areas, allows for the formation of distinct colored bands that can be read visually. The complex of antibody-dye + antigen is captured by antibody on the membrane and a red line appears at the test band on the membrane. If the sample contains sperm below the detection level, no line appears at the test band.

Anti-species IgG antibodies are immobilized at the control band. These antibodies will bind to unreacted/excess antibody-gold conjugates, resulting in the formation of a distinct line at the control band. Line formation serves as a control to demonstrate that lyophilized antibodies in the dye pad have been hydrated and that sufficient sample has been applied to allow for migration to the test band and beyond. If a control line does not appear within the designated incubation time, the test is invalid and should be repeated.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

   a. Precision/Reproducibility:

   Precision was performed by carrying out the test for two days by three different operators with two lots of devices. The semen samples were prepared by diluting the pooled normal semen to the appropriate sperm concentrations. The samples were randomly distributed. The tested concentrations were 30,200,000, 21,600,000, 10,100,000, 5,200,000, 3,000,000, 980,000 sperm/mL. The test results agreed 100% with the expected results. No significant difference in the performance was found between lots, days, and operators.

   b. Linearity/assay reportable range:

   Not applicable.

   c. Traceability, Stability, Expected values (controls, calibrators, or methods):

   Stability

   Real time stability testing was performed. At each test time point, negative, very low positive (approximately the level of sensitivity), and medium positive (2 times the level of sensitivity) controls were tested in triplicate for each sample level Three lots of test devices have been tested and the test results are acceptable up to 16 months at ambient temperature.

   d. Detection limit:

   A pooled semen sample from normal men was diluted with a pooled semen sample from vasectomized male donors to sperm concentrations of 21,300,000, 15,500,000 and 10,700,000 sperm/mL. Each concentration was tested in eight (8) replicates with SpermCheck® Fertility test. The results support the 20,000,000 sperm/mL (i.e., 20M/mL) Sensitivity level of the SpermCheck® Fertility test as follows.

Sperm Concentration ($x10^6$ Sperm/mL)	Percent Positive (Positive/Total)	Percent Negative (Negative/Total)
10.7	0 (0/8)	100 (8/8)
15.5	62.5 (5/8)	37.5 (3/8)
21.3	100 (8/8)	0 (0/8)

d. Analytical specificity:

The cross-reactivity and potential interference of various substances on the SpermCheck® Fertility test were tested using substance-spiked semen samples. Each substance was spiked into 20M sperm/mL samples and also into vasectomized semen samples (no sperm in the semen) to obtain the desired concentrations. All tested substances showed no cross-reactivity or potential interference on the SpermCheck® Fertility test at the level tested as follows.

Substances	Test Concentration
Escherichia coli	1 x 10^7/mL
Corynebacterium diptheria	1 x 10^7/mL
Neisseria gonorrhea	1 x 10^7/mL
Chlamydia trachomatis	3.1 x 10^5/mL
19-Norethindrone acetate	20 µg/mL
Testosterone	20 µg/mL
β-Estradiol	20 µg/mL
D(-) Norgestrel	20 µg/mL
Whole Blood	10%
Urine	10%
Saliva	10%

f. Assay cut-off:

Not applicable

2. Comparison studies:

a. Method comparison with predicate device:

The WHO standard procedure of determining sperm concentration with a hemacytometer was used as a reference method to establish the performance of the SpermCheck® Fertility test. Semen samples were either collected from 194 men who participated in the study or obtained as de-identified post-vasectomy clinical specimens (n=33). Two of the samples collected from the study participants were excluded from the analysis either because the subject did not observe the required 48 hour abstinence period (n=1) or because the volume of the ejaculate was insufficient for testing (n=1). A total of 225 samples were counted with a hemacytometer following a standard operating procedure and tested with SpermCheck® Fertility test by a laboratory professional. Since the detection level of SpermCheck® Fertility test is 20,000,000 sperm/mL, the data comparison was made with this concentration as a decision level between positive and negative as follows.

		SpermCheck® Fertility test		
		Positive	Negative	Total
Hemacytometer	Positive (≥20,000,000 sperm/mL)	156	0	156
	Negative (<20,000,000 sperm/mL)	4	65	69
	Total	160	65	225

Negative Predictive Value (NPV): 1.000
Positive Predictive Value (PPV): 0.975
Sensitivity: 100%
Specificity: 94%
Accuracy: 98%

b. Matrix comparison:
Not applicable

3. Clinical studies:
   a. Clinical Sensitivity:
   Not applicable
   b. Clinical specificity:
   Not applicable
   c. Other clinical supportive data (when a. and b. are not applicable):
      (i). *Consumer Use Study*: A consumer use study was conducted to determine the test performance when used by unassisted lay users following the instructions in the package insert. The study was conducted in two ways: 1) Performance of the consumer at home with his own semen sample; 2) Performance of the consumer with provided semen samples.

      In the study of the consumer at home with his own semen sample, 61 participants in this study obtained 52 positive and 8 negative SpermCheck® Fertility test results. One test was invalid. There was 95.1% (58/61) agreement between the results obtained by the home users and those obtained by laboratory professionals reading the same test device.

      In the study of consumers provided with semen samples, 41 people (38 male and 30 female) participated. All results showed 100% agreement.

Sample ID	Concentration (Sperm/mL)	Negative	Positive	Invalid	Total	% Correct
A	30,000,000	0	41	0	4 1	100
B	1,250,000	41	0	0	41	100
C	60,000,000	0	4 1	0	4 1	100
D	7,500,000	41	0	0	41	100
Total		82	82	0	164	100

      (ii). *High Dose Hook Effect Study:* To assess whether the SpermCheck® Fertility test device would give false negative results with very high concentrations of sperm due to the hook effect, semen samples of various sperm concentrations of up to 254 million sperm/mL were tested. The results were read by an optical density reader. The signal intensity increased as the sperm concentration increased and no signal reduction was observed. In a separate study, a total of 21 clinical samples with sperm concentrations ranging from 22.2 million sperm/mL to 741 million sperm/mL were tested with SpermCheck® Fertility test. All samples showed positive test results, and no false negative result due to the hook effect.

4. Clinical cut-off**:**
   Not applicable
5. Expected values/Reference range:
   Not applicable

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

O. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.