Postcoital Sperm Assessment Comparative Study

MICHAEL J. PELEKANOS, MD
VICE CHAIRMAN
DEPARTMENT OF OBSTETRICS AND GYNECOLOGY
FORBES REGIONAL HOSPITAL
MONROEVILLE, PA

ABSTRACT

This postcoital sperm assessment study was performed over a 10 month time period (November 2014–August 2015). Fifteen couples enrolled in the study. The study was a non-blinded, non-randomized, single-center comparison study comparing The Stork® OTC (Rinovum Women's Health, Monroeville, PA) to natural intercourse (NI), using the subjects as their own control/baseline. This was an efficacy study designed to compare the number of sperm in the cervical mucus following the use of The Stork OTC conception aid with the number of sperm in the cervical mucus following natural intercourse. Subjects used both The Stork OTC conception system and the natural intercourse method to evaluate concentrations of sperm in the cervical mucus. Post-coital test (PCT) data was collected demonstrating higher concentrations of sperm within the cervical mucus with The Stork OTC conception system versus natural intercourse for 85% of test subjects in this study. Of the 15 couples enrolled in the study, 2 were lost to follow-up. Mean age for male subjects was 31.7 +/ 5.4 years of age and mean age for female subjects was 29.7+/- 5.4. The average sperm score value of the 85% of test subjects with higher sperm concentrations from The Stork OTC was 3.23 times the score value of sperm concentration compared to natural intercourse. The remaining 15% of test subjects showed no change in sperm score value between The Stork OTC and natural intercourse.

INTRODUCTION

During cervical cap insemination, a cervical cap is used to hold sperm close to the cervix. Evidence of the use of this method dates back to the 1950's when it was documented as a treatment for oligospermia (low sperm count).[1] The materials for these caps ranged from plastic to surgical steel. Recommended timing for placement on the cervix has historically varied from 6 to 24 hours. Cervical cap insemination was used in the 1970s and 1980s and was shown to improve pregnancy rates in couples with both primary and secondary infertility in the first six months of use.[2] It was determined by a study in 1985 that home use of conception caps is as effective as office-based ICI programs with respect to pregnancy rates and has the advantages of reduced cost and greater privacy and convenience.[3]

The PCT is a commonly used physician diagnostic procedure used in the evaluation of cervical factor infertility. PCT is commonly used to access quantity and the ability of sperm to penetrate and survive in cervical mucus. Microscopic inspection of mucus presents information on the concentration, motility, and progression of sperm in the mucus. Macroscopic inspection of the mucus is useful for assessment of spinbarkeit, overall mucus quality, and quantity.

Successful PCT implies satisfactory intercourse technique, normal cervical mucus for transport and preservation of sperm, adequate ovarian estrogenic function, and adequate sperm. This test, however, is not a substitute for a semen analysis and complements that analysis as a tool to support diagnosing infertility.

DEVICE INFORMATION

In an attempt to provide more ease of use to the cervical cap insemination process, Rinovum® has developed the Stork® and The Stork® OTC home use conception assistance kits that do not require manual transfer from the collection condom to the cervical cap (Fig. 1). This is accomplished by merging the collection condom and cervical cap into one unit, the Conceptacle® (a component within The Stork OTC system) (Figs. 2 and 3).

To avoid difficulty with insertion of the sperm-filled cervical cap into the vagina and onto the cervix, The Stork and The Stork OTC designs include an applicator to guide the cervical cap into the vagina (while protecting the sperm from spilling out) and onto the cervix (Fig. 4). Once the cervical cap is placed near the cervix, the applicator is removed and discarded. (This process is comparable to plastic applicator tampon insertion.)

The applicator adds a removal string to the Conceptacle® when it is loaded onto the applicator. This combination allows the sperm to be positioned closer to the cervical os and provides for easy removal after a period of time of up to six hours (Figs. 5 and 6).

Typical cervical cap placement durations of 4 to 6 hours for The Stork OTC were extended to 4 to 12 hours for the purposes of the study to allow for travel time for participating couples to return to the principal investigator's (PI) office for examination.

The Stork and The Stork OTC conception aid devices are both cleared for marketing by the FDA. The prescription version, The Stork, was cleared in 510(K) K112200 on 06 September 2012 and The Stork OTC was cleared in K140186 on 11 July 2014. This study was conducted in accordance with 21 CFR Part 812, Investigational Device Exemptions.

STUDY DESIGN

The study was a non-blinded, non-randomized study comparing the result of intercourse using The Stork

Figure 1.The Stork® OTC device.

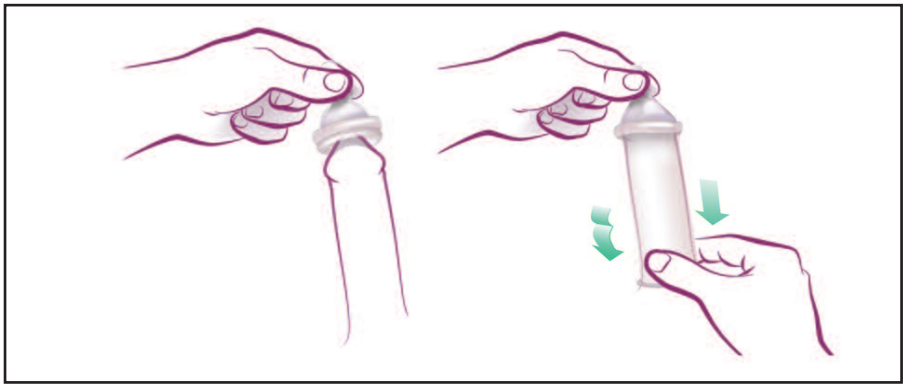

Figure 2. Conceptacle® for the male worn like a traditional condom.

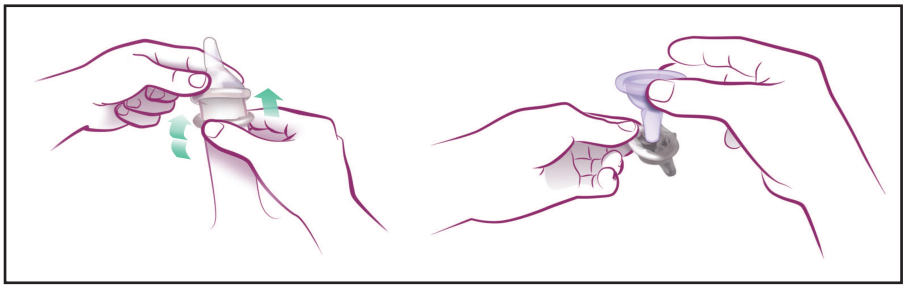

Figure 3. Removal of Conceptacle® readied for loading into introducer.

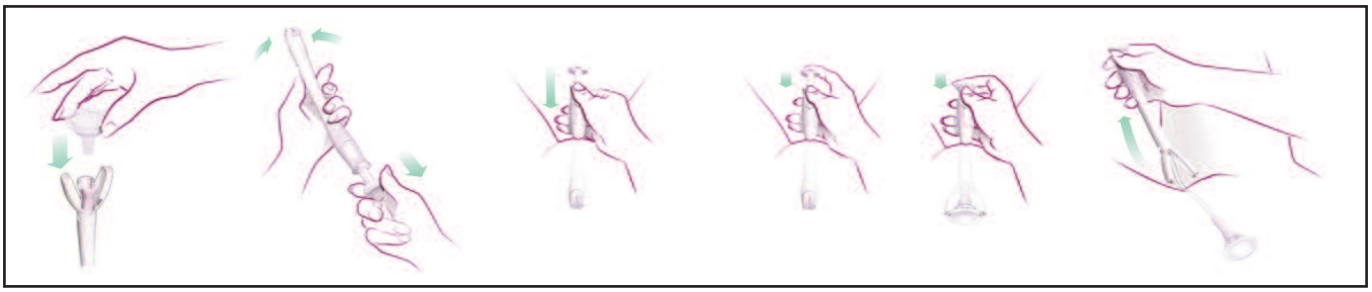

Figure 4. Loading Conceptacle® cap into introducer, sealing, track to cervix, release.

OTC to the result of natural intercourse (control/baseline) with each couple serving as their own control. The study's aim was to compare the standard PCT within 4 to 12 hours and after intercourse—with and without use of The Stork® OTC conception aid—to determine if the PCT results demonstrate higher sperm concentration in the cervical mucus after utilizing The Stork OTC during intercourse.

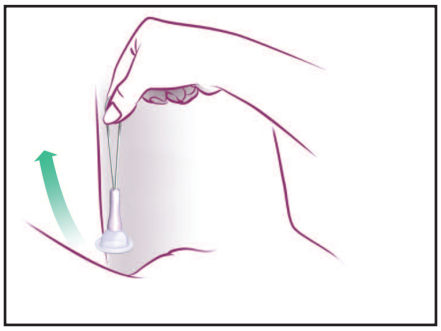

Figure 5. Cap deploying at cervix.

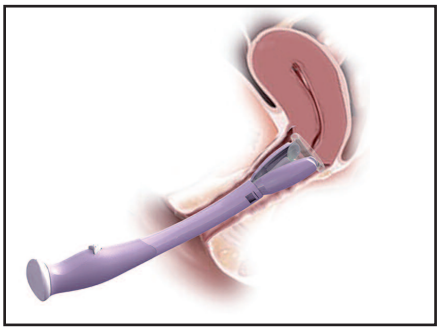

Figure 6. Remove cap from vagina.

MATERIALS AND METHODS

Participating couples were recruited with the use of an advertisement/flyer posted in the PI's office and in the local newspapers. Interested candidate-couples contacted the PI. The participants were informed that participation was voluntary and the decision to participate or not would not in any way affect their future care. Subsequently, the participants were given a complete and thorough explanation of the benefits and risks or discomforts that may be anticipated with this study. Participants met all of the inclusion/exclusion criteria and informed consent was obtained prior to enrollment in the study.

Participating couples received $100 after their participation in the study as compensation for travel and participation time. Eligible participants were 20–45 years of age, in good general health, with only one sexual partner, and willing to follow the protocol.

Female exclusion criteria included a recent history (within six months of enrollment) of sexually transmitted disease (STD) and breastfeeding or pregnancy at the time of the study. Male exclusion criteria included surgical sterilization, a recent history (within six months of enrollment) of a STD, and/or male factor infertility.

Subjects were discontinued if any of the following were noted during the study:

1. The subject persists to have hostile mucus.
2. The subject had more than one positive wet mount for yeast or bacterial vaginosis.
3. One or both subjects tested positive for STDs (including gonorrhoeae and chlamydia).
4. Any current illness that would jeopardize the subject's health or the interpretation of the results of the study.
5. One or both subjects were unable to comply with protocol.
6. One or both subjects requested to withdraw.
7. The investigator determined that it was no longer in the best medical interest of the subject to continue with the study.

Table I.
Score values were determined for progressive, non-progressive, and immotile sperm utilizing a standard value system[4,5] of the following:

Sperm Count within Field	Sperm Score Value
5 or less sperm	**1**
5–10 sperm	**4**
Too numerous to count	**10**

The three independent score values were recorded then averaged.[4] World Health Organization (WHO); (1999): Laboratory Manual for the Examination of Human Semen and Sperm-Cervical Mucas Interaction, Cambridge Press, 51–59.5 Mortimer, David, and Sharon T. Mortimer. "Laboratory investigation of the infertile male." Textbook of in Vitro Fertilization and Assisted Reproduction. The Bourn Hall Guide to Clinical and Laboratory Practice. Abingdon, UK: Taylor & Francis (2005): 65–72.

Table II
Participant screening

	Inclusion Checklist	Met Criteria										Excluded				
Patient #	Informed Consent Signed	Participants between ages 20-50 years of age	Sexually Active Couple	Trying to conceive or taking a non-vaginal form of birth control	Previous Condom Use	No recent history of Sexually Transmitted Disease	Not Breast feeding or pregnant	Male has not been surgically sterilized	Stable relationship, single partner	Signed informed consent	Pregnancy Test showing NOT pregnant	Existing bacterial vaginosis	Vaginal tract medical intervention within the last 3 months	Vaginal prolapse	Hysterectomy	Surgical Sterilization
001/002	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
003/004	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
005/006	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
007/008	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
009/010	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
011/012	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
013/014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
015/016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
017/018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
019/020	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
021/022	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
023/024	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
025/026	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
027/028	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No
029/030	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	no	No	No

After providing informed consent, each female subject underwent a medical history interview, pregnancy test, PAP smear (test for STD's and vaginal pathogens), and a pelvic exam. If vaginal candidiasis or bacterial vaginosis were diagnosed, the subject would be treated and disqualified as a study participant.

Each subject was asked to come to the primary investigators facility to complete and sign the informed consent and to receive a brief overview of the study, the product, and the study requirements. Subjects then received a complete The Stork® OTC device, instructions for use, and guidelines with respect to timing for each event and follow-up visit after intercourse.

Participating couples had sexual intercourse at two different monthly cycles—both at mid-cycle, as determined by an ovulation predictor kit (one day after a significant color change, approximately day 14 of a 28 day cycle). Sexual intercourse was performed once while using The Stork OTC and once while performing unprotected natural intercourse. Male subjects were asked to abstain from ejaculation three days prior to testing. After each instance of intercourse, the female subject was asked to return to the PI's office within 4 to 12 hours to participate in a post-coital exam.

Subjects were asked not to use lubricants or spermicides during intercourse. Female subjects were also informed not to douche or take a bath until the post-coital test was completed.

During the post-coital test procedure, the principle investigator aspirated the endocervical mucus. The mucus was then evaluated under low-power (100x) magnification for the presence of sperm. If sperm was seen, the slide was then evaluated under high-power (450x) magnification and the investigator recorded the number of progressively motile sperm, non-progressively motile sperm, and immotile sperm per single high power field (HPF).

The case report form (CRF) was used by the principal investigator to document results of the screening, demographics, and examination assessments.

Table III
Participant demographics

Patient #	Age (M)	Age (F)	First Menstrual Cycle	Ave. length of cycle	Given Birth before?	Aware of any abormalities with reproductive system (M)	Aware of any abormalities with reproductive system (F)
001/002	35	33	20/12/2015	14	Yes	No	No
003/004	25	22	15/01/2015	unknown	No	No	No
005/006	32	27	29/01/2015	14	No	No	No
007/008	38	29	unknown	14	Yes	No	No
009/010	28	27	26/01/2015	15	No	Low sperm	No
011/012	24	23	30/01/2015	17	No	No	No
013/014	29	31	31/01/2015	15	No	No	No
015/016	38	33	13/02/2015	14	No	No	No
017/018	36	33	17/02/2015	12	No	No	No
019/020	31	31	06/02/2015	16	No	No	No
021/022	39	27	11/03/2015	15	No	No	No
033/044	27	27	26/03/2015	14	No	No	No
025/026	39	37	07/03/2015	14	No	No	Border-line FSH
027/028	25	31	09/04/2015	13	No	No	No

Table IV
Physician screening

Patient #	Pregnancy test Positive (+) or Negative (-)	Vaginal Candidiasis Yes/No	Bacterial Vaginosis Yes/No	Urinary tract Infection Yes/No	General Comments
001/002	Negative	No	No	No	Normal
003/004	Negative	No	No	No	Normal
005/006	Negative	No	No	No	Normal
007/008	Negative	No	No	No	Normal
009/010	Negative	No	No	No	Normal
011/012	Negative	No	No	No	Normal
013/014	Negative	No	No	No	Normal
015/016	Negative	No	No	No	Normal
017/018	Negative	No	No	No	Normal
019/020	Negative	No	No	No	Normal
021/022	Negative	No	No	No	Normal
033/044	Negative	No	No	No	Normal
025/026	Negative	No	No	No	Normal
027/028	Negative	No	No	No	Normal
029/030	Negative	No	No	No	Normal

SAMPLE-SIZE AND POPULATION

A minimum of 10 sexually active, monogamous, heterosexual couples between the ages of 20 and 45 were required for the study, and 15 were eventually enrolled. The subject population was in good general health, not using hormonal birth control or IUD, not surgically sterilized, and experienced with the use of condoms. Subjects were either trying to conceive or using a non-vaginal birth control. Thirteen couples completed the study, with 2 couples lost to follow-up. Mean age for male subjects was 31.7 +/ 5.4 years of age and the mean age for female subjects was 29.7 +/- 5.4.

RESULTS

The study was a non-blinded, non-randomized, single-center study comparing The Stork® OTC to natural intercourse (control/baseline) with participating couples serving as

Table V.
Post-coital data

		Mucus Quality								Field Data			
Patient #	Natural Intercourse (NI) or Stork	Cervical Mucus Volume (ml)	Cervical Mucus Score: ml 0=0ml, 1= 0.1ml, 2 = 0.2ml, 3=0.3ml	Clarity	Spinbarkeiting (cm)	Spinbarketing Score: 0=<1cm, 1=1-4cm, 2=5-8cm, 3= 9 or more cm	Mucus Quality:	Mucus Quality Score: 1= poor, 2= good, 3= excellent	Total Score	Progressive Motile sperm Field 1 Score: (1 = 5 or Less, 4= 10 or less, 10 = Too numerous to count)	Non-Progressive Motile sperm Field 1 Score: (1 = 5 or Less, 4= 10 or less, 10 = Too numerous to count)	Immotile sperm Field 1 Score: (1 = 5 or Less, 4= 10 or less, 10 = Too numerous to count)	Average TOTAL Score: (1 = 5 or Less, 4= 10 or less, 10 = Too numerous to count)
001/002	NI	0.2	2	Clear	6	2	Poor	1	5	1	1	1	1.0
	Stork	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
003/004	NI	0.1	1	Clear	7	2	Good	2	5	1	1	1	1.0
	Stork	0.2	2	Clear	6	2	Good	2	6	4	4	1	3.0
005/006	NI	0.3	3	Clear	8	3	Good	3	8	1	1	1	1.0
	Stork	0.2	2	Clear	7	2	Good	2	6	4	1	4	3.0
007/008	NI	0.2	2	Clear	6	2	Good	2	6	1	1	1	1.0
	Stork	.2`	2	Clear	9	3	Good	3	8	10	1	4	5.0
009/010	NI	0.2	2	Clear	4	1	Good	1	4	1	1	1	1.0
	Stork	0.2	2	Clear	7	3	Excellent	3	7	4	4	4	4.0
011/012	NI	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
	Stork	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
013/014	NI	0.3	3	Clear	5	2	Excellent	3	8	4	1	4	3.0
	Stork	0.3	3	Clear	8	2	Excellent	3	8	4	1	4	3.0
015/016	NI	0.1	1	Clear	5	2	Good	2	5	1	4	1	2.0
	Stork	0.2	2	Clear	5	2	Good	2	6	4	1	1	2.0
017/018	NI	0.3	3	Clear	8	2	Good	2	7	4	4	1	3.0
	Stork	0.2	2	Clear	7	2	Good	2	6	4	4	4	4.0
019/020	NI	0.1	1	Clear	8	2	Good	2	5	1	1	1	1.0
	Stork	0.3	3	Clear	8	2	Excellent	3	8	10	4	1	5.0
021/022	NI	0.2	2	Clear	9	3	Excellent	3	8	1	4	4	3.0
	Stork	0.3	3	Clear	8	3	Good	2	8	1	10	4	5.0
023/024	NI	0.2	2	Clear	4	1	Good	2	5	1	4	4	3.0
	Stork	0.2	2	Clear	8	2	Good	3	7	4	4	4	4.0
025/026	NI	0.3	3	Clear	6	2	Excellent	3	8	1	1	1	1.0
	Stork	0.3	3	Clear	5	2	Excellent	3	8	10	4	1	5.0
027/028	NI	0.1	1	Clear	2	1	Poor	1	3	1	1	1	1.0
	Stork	0.2	2	Clear	4	1	Good	2	5	10	1	4	5.0
029/030	NI	0.3	3	Clear	8	2	Excellent	3	8	1	10	4	5.0
	Stork	0.3	3	Clear	7	2	Excellent	3	8	4	10	4	6.0

their own control/baseline. This was an efficacy study designed to compare the number of sperm in the cervical mucus within 4 to 12 hours of both natural intercourse and intercourse using The Stork® OTC. Subjects used The Stork OTC Conception System, which has been cleared for market by the FDA (K112200 and K140186), and Natural Intercourse method as a control to evaluate concentrations of sperm in the cervical mucus. The cervical cap placement durations of 4 – 6 hours for The Stork OTC were extended to 4 – 12 hours for the purposes of the study to allow for travel time for participating couples to return to the PI's office for examination.

Thirteen couples completed the study with 2 couples lost to follow-up. Mean age for the male subjects was 31.7 +/ 5.4 and the mean age of the female subjects was 29.7 +/- 5.4. Two of the 15 subjects had children previously, one subject had a male partner previously diagnosed with low sperm count, and a different subject was previously diagnosed with border-line follicle stimulating hormone (FSH).

All 13 female subjects were within a logical ovulation window for their specific cycle.

Eleven of the 13 total subjects (85%) demonstrated a higher concentration of sperm or score value in the cervical mucus when using The Stork OTC compared with natural intercourse. These subjects showed an average of 3.23 times the sperm score value within the cervical mucus using The Stork OTC compared to their values from natural intercourse.

The remaining 2 subjects showed no change in sperm count or score value in the cervical mucus when using The Stork OTC compared to natural intercourse (Figs. 7 and 8).

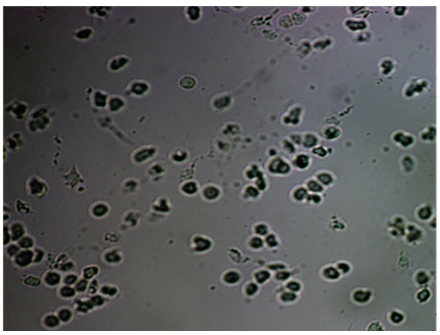

Figure 7. Subject 017/018. Specimen under magnification, natural intercourse, sample image.

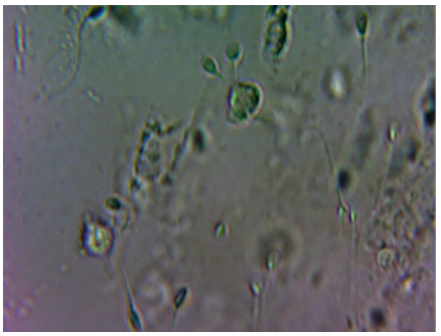

Figure 8. Subject 017/018. Specimen under magnification, The Stork OTC©, sample image.

CONCLUSION

The importance of evaluating sperm concentration within the cervical mucus post-coitus is an established diagnostic tool when evaluating fertility.[6,7] The primary role of the PCT is to evaluate sperm quality and quantity, as well as mucus quality, making PCT the appropriate tool in this specific comparison study to evaluate sperm concentrations.

This clinical study demonstrated that 85% of the subjects completing the study showed a higher concentration of sperm within the cervical mucus when using The Stork OTC compared to natural intercourse. Additionally, the remaining 15% of subjects tested showed no change in sperm count or score value between The Stork OTC and natural intercourse.

The study demonstrated that in 85% of subjects, The Stork OTC delivered an average of 3.23 times the sperm score value within the cervical mucus compared to natural intercourse and that The Stork OTC does present a greater concentration of sperm to the targeted cervical mucus than natural intercourse. STI

AUTHOR'S DISCLOSURES

Dr. Pelekanos is a medical advisor for, and received study-support from, Rinovum® Women's Health.

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