

# Methods of semen collection not based on masturbation or surgical sperm retrieval

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**Although masturbation is the standard method for the collection of a sperm sample, both for diagnostic and therapeutic purposes, other approaches have been described and assessed. Production of semen using specially designed condoms has been shown to result in samples with better laboratory characteristics than samples obtained after masturbation or coitus interruptus. However, this has not resulted in a general acceptance and use of this approach, except in special circumstances where masturbation is impossible or unacceptable. Direct retrieval of spermatozoa from morning urine is another method which has been used to study spermache in boys, but not to treat infertility. Sperm production techniques such as vibro- and electrostimulation are dealt with elsewhere, as are surgical retrieval techniques used in azoospermia.**

*Key words:* non-masturbation/non-surgical/semen collection/spermatozoa in urine/sperm retrieval

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## Introduction

The standard procedure to obtain an ejaculate is by masturbation. The sample is either produced by the patient himself, or may be obtained through masturbation elicited by vibro- or electrostimulation. In normal circumstances, the ejaculate is usually collected as a whole specimen in a clean jar after a standardized period of abstinence, usually three days. Occasionally, a split ejaculate can be requested or the ejaculate can be collected in a jar containing a medium, especially if there are high sperm antibody titres. A complete ejaculate allows examination of all components of the ejaculate, both cellular and biochemical, after a precise ejaculation–examination interval. The procedure is generally well accepted, easy, cheap and hygienic, and also allows bacteriological testing. In the majority of cases, requesting a masturbated sample is therefore the unquestioned and preferred way to obtain spermatozoa for all types of diagnostic and therapeutic purpose. Vibro- and

electrostimulation before masturbation will be dealt with elsewhere. Surgical retrieval techniques, e.g. microsurgical epididymal sperm aspiration (MESA) and testicular sperm extraction (TESE) with their variants, as well as puncture from the vesicula seminalis or from the vas deferens, intended to obtain spermatozoa from azoospermic men have been treated extensively in the recent literature and are not within the scope of this article. Table I provides an overview of all methods for collecting spermatozoa.

However, as the need to obtain large numbers of motile spermatozoa has diminished, given the excellent results of in-vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), alternative means of obtaining spermatozoa have become relevant to clinical practice in men who cannot produce ‘adequate’ specimens by normal antegrade ejaculation. There may also be religious and personal or psychological barriers against masturbation. Therefore, alternative ways to obtain a sperm sample may be considered in specific clinical circumstances. It is these rather exceptional circumstances that this contribution reviews.

There are three forms of sperm collection not covered by either masturbation in its widest sense, or by surgical sperm retrieval: (i) collection of spermatozoa after normal sexual intercourse with vaginal ejaculation using specially designed condoms; (ii) collection of spermatozoa after vaginal ejaculation not using a condom; and (iii) sperm retrieval from morning urine.

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**Table I.** Methods of sperm collection

With masturbation	Without masturbation
Normal anterograde ejaculation in a receptacle (full or split ejaculate)	Vaginal intercourse with the use of specially designed condoms
Retrograde ejaculation and voiding	Vibro-ejaculation Electro-ejaculation Centrifugation of morning urine Aspiration of vesiculae seminales Surgical retrieval: MESA/PESA – TESA/TESE Ductus deferens puncture Alloplastic spermatoceles Natural spermatoceles

MESA = microsurgical epididymal sperm aspiration;

PESA = percutaneous epididymal sperm aspiration;

TESA = testicular sperm aspiration;

TESE = testicular sperm extraction.

### Masturbation versus coitus condomatus

The collection of a masturbated sample may be proscribed on religious grounds, e.g. in orthodox Jews (Gordon *et al.*, 1975). Some patients, on educational grounds or because of psychological impediments, may refuse or declare themselves unable to produce a sperm sample on command. To circumvent this problem, the use of a polyethylene sheath—called the Milex sheath—was suggested (Mehan and Chevhal, 1977) and produced by the Dow Corning Corporation, Midland, Michigan, USA. Although non-spermicidal, the Milex condom was impractical in its use. Subsequently, a newer Silastic seminal fluid collection device was developed by the same company, and which was claimed to have the advantages of a latex condom with none of its spermicidal qualities. (Silastic is the registered trade name for a dimethylpolysiloxane elastomer, a silicone compound which is non-reactive with living tissues.)

The properties of the Milex condom, the latex condom, the Silastic seminal fluid collection device (SCD) and the usual glass containers were compared *in vitro* (Schoenfeld *et al.*, 1978). Fifty sperm samples, which were ejaculated into a glass container, were divided into four aliquots each of 0.5 ml and placed into each of the four receptacle types; the receptacles were maintained at 25°C. The percentage of motile spermatozoa, and the percentage of spermatozoa with progressive motility, were determined after 0, 1, 2, 3 and 4 h and the mean values compared between the four groups.

Motility characteristics remained almost unaffected by contact with either the Silastic device or the glass container, whereas both parameters were much reduced by contact with the Milex sheath and the latex condom (Tables II and III). The residual amount of seminal fluid remaining in the Milex sheath and in the SCD was compared (Table IV) and found to be significantly higher with the Milex condom, resulting in a higher total yield using the SCD. Thus, in conclusion, a latex

condom should never be used for the collection of a semen specimen. The Silastic device allows for a more accurate determination of total sperm count.

Furthermore, a number of subjective characteristics of the Milex sheath and SCD, including fit, colour, donning ease, removal ease, tactile characteristics, strength and comfort were compared by 40 patients. All considered the Silastic device to be either much better (85%) or slightly better (15%) than the Milex sheath.

In a subsequent study, sperm characteristics were compared between samples produced by masturbation into a glass container and those produced by sexual intercourse with the use of a SCD (Zavos, 1985). In total, 30 males participated in the study, 13 with oligoasthenoteratospermia and 17 with normal sperm characteristics. The study was cross-over in design, with 15 patients firstly producing a sample by masturbation and then by intercourse, and vice versa. Patients were advised to restrain from ejaculation for as long as possible in order to elicit maximal sexual stimulation. Results (Table V) showed that the actual and percentage increases in seminal parameters of ejaculates collected both from oligospermic and normospermic patients via masturbation with the use of a SCD were significantly better than following masturbation into a glass jar. The 'improvement' was especially noticeable in oligospermic patients. Therefore, it appears that for cervical cap insemination, intrauterine insemination, IVF and ICSI, coitus condomatus in a SCD is preferable to regular masturbation. An explanation for the difference was thought to be the considerable control that cerebral activity exerts over the emission phase (Newman *et al.*, 1982). Moreover, experience in cattle has shown that maximal sexual arousal by restraint of bulls or false mounts does increase numbers of motile spermatozoa by 50% (Salisbury *et al.*, 1961).

Similar experiments were conducted (Zavos and Goodpasture, 1989) in men with more specific sperm deficiencies and similar results were obtained: patients with seminal deficiencies in masturbated samples showed greater improvements in semen parameters than the non-deficient groups with which they were compared.

Others have compared a number of characteristics of semen collected via masturbation versus sexual intercourse with a Silastic device, and have drawn similar conclusions (Sofikitis and Miyagawa, 1993) (Table VI). However, these findings have been challenged by others (van Roijen *et al.*, 1996), who could not find a difference between conventional sperm characteristics of both infertile men and sperm donors after masturbation in a condom with and without explicit visual erotic stimulation. They hypothesized that visual erotic stimulation was the most likely explanation for putative differences in sperm characteristics after coitus versus masturbation, but their findings did not corroborate this hypothesis.

**Table II.** Percentage<sup>a</sup> of motile spermatozoa in semen samples collected in different receptacles

Receptacle	Time (h)				
	0	1	2	3	4
Silastic seminal fluid collection device	52.2 ± 3.1	51.8 ± 2.0	48.2 ± 2.1	44.2 ± 1.9	40.2 ± 2.0
Milex seminal sheath	52.2 ± 3.1	51.0 ± 1.9	44.0 ± 2.3	38.6 ± 1.9	32.2 ± 2.1
Latex condom	52.2 ± 3.1	11.2 ± 1.8	7.2 ± 1.0	0.2 ± 0.1	0
Glass container	52.2 ± 3.1	52.0 ± 2.1	50.4 ± 1.9	44.2 ± 2.0	40.2 ± 2.0

<sup>a</sup>Values are means ± SE.**Table III.** Percentage<sup>a</sup> of spermatozoa with progressive motility in semen samples collected in different receptacles

Receptacle	Time (h)				
	0	1	2	3	4
Silastic seminal fluid collection device	2.6 ± 0.01	2.5 ± 0.02	2.3 ± 0.03	2.3 ± 0.03	2.1 ± 0.03
Milex seminal sheath	2.6 ± 0.01	2.3 ± 0.02	2.0 ± 0.02	2.0 ± 0.02	1.8 ± 0.03
Latex condom	2.6 ± 0.01	0.9 ± 0.05	0.3 ± 0.06	0.04 ± 0.03	0
Glass container	2.6 ± 0.01	2.5 ± 0.03	2.3 ± 0.04	2.2 ± 0.04	2.0 ± 0.03

<sup>a</sup>Values are means ± SE.**Table IV.** Comparison of the amounts of seminal fluid collected and retained in a Milex sheath versus a Silastic seminal fluid collection devices

	Weight (g) <sup>a</sup>		
	Before use	After use and removal of semen	Residual amount of semen (ml)
Milex sheath	0.412 ± 0.004	1.413 ± 0.002	1.001
Silastic seminal fluid collection device	3.082 ± 0.003	3.408 ± 0.017	0.326

<sup>a</sup>Values are mean ± SE.

In contrast, biophysical and biochemical parameters of semen collected either by masturbation or after coitus condomatus appear to be similar (Purvis *et al.*, 1986; Sofikitis *et al.*, 1993). Assessment of accessory gland function can thus be made equally well with masturbated or post-coital sperm samples. However, both studies found a significantly higher volume after coitus than after masturbation, adding further evidence to the fact that full coitus does result in better sperm criteria than ejaculation in a hand-held receptacle, which at the cerebral level probably does inhibit the emission phase.

The same authors also compared the characteristics and the percentage increase in seminal parameters of ejaculates via complete coitus or coitus interruptus (Zavos *et al.*, 1998) and found semen parameters to be significantly better after complete coitus in a SCD than after ejaculation in a glass receptacle following incomplete coitus.

The conclusion from all these data should evidently be that, for reasons of artificial reproductive technology, masturbation as a method for semen collection should not be recommended, and be

replaced by coitus in an SCD. Nevertheless, masturbation has remained world-wide the method of choice to obtain semen. It remains difficult to explain why. One reason may be that the published data have originated mostly from only one group and have not been reproduced by others. Another reason is that it takes more time to counsel the patient properly in how to use the SCD correctly, especially how to empty it, and using a small rod to squeeze its contents into the receptacle. If this must be done by the patient, it may be carried out incorrectly; if it must be done by laboratory personnel, it is likely to encounter some resistance. Clearly, further clinical studies in men with sperm deficiencies are warranted to see whether indeed the characteristics of samples are better after intercourse and the samples may therefore be used for intrauterine insemination (IUI) instead of IVF and for IVF instead of ICSI. On the other hand, a prospective study using pregnancy rates as an end-point rather than sperm parameters in IUI and IVF/ICSI must be performed before abandoning masturbation as the standard method for sperm collection.

Nonetheless, the reported data suggest that in specific cases where masturbation is not possible or is refused, an excellent alternative is available. This is especially the case in orthodox Jews, who accept masturbation only for diagnosis, and even then reluctantly. Retrieval and examination of spermatozoa obtained at post-coital testing or obtained after coitus condomatus perforatus is usually preferred (Hirsh, 1996). The use of spermatozoa obtained from the vagina or the cervix after full coitus without any device has been suggested for use in ICSI (Hirsh, 1996) in patients who wish to remain in strict accordance with the Old Testament prohibition of masturbation, or who wish to preserve the dignity of marriage and the intimacy of coitus in line with orthodox Christianity.

**Table VI.** Biophysical parameters of semen collected via masturbation (MAST) versus sexual intercourse (INTER) with a Silastic device in normospermic males<sup>a</sup>

	Total sperm content ( $\times 10^6$ )	Volume (ml)	Motile spermatozoa (%)	Motility grade (0–4)	Normal spermatozoa (%)	pH	Grade of satisfaction (0–4)
MAST ( $n = 38$ )	44.3 $\pm$ 5.6	2.3 $\pm$ 0.2	11.3 $\pm$ 4.5	1.4 $\pm$ 0.2	23.3 $\pm$ 4.6	7.7 $\pm$ 0.2	1.2 $\pm$ 0.2
INTER ( $n = 38$ )	99.4 $\pm$ 9.4	3.3 $\pm$ 0.2	32.1 $\pm$ 5.1	2.7 $\pm$ 0.2	41.2 $\pm$ 5.1	7.1 $\pm$ 0.2	2.9 $\pm$ 0.0

<sup>a</sup>Values are mean  $\pm$  SE.**Table V.** Characteristics of ejaculates collected via intercourse with the use of the seminal fluid collection device (I-SCD) and via masturbation (MAST) from oligospermic and normospermic patients

Patient group	Sperm parameters assessed <sup>a</sup>						
	Ejaculate production	Volume (ml)	Total no. of spermatozoa ( $\times 10^6$ )	Motility (%)	Grade (0–4)	Morphological features (% normal)	TFSF ( $\times 10^6$ )
Oligospermic ( $n = 13$ )	I-SCD	3.2 $\pm$ 0.3 <sup>a</sup>	56.9 $\pm$ 9.7	55.6 $\pm$ 9.7	2.6 $\pm$ 0.2	41.3 $\pm$ 2.7	11.6 $\pm$ 0.6
	MAST	2.2 $\pm$ 0.3	18.5 $\pm$ 3.7	45.6 $\pm$ 6.0	2.3 $\pm$ 0.2	33.8 $\pm$ 3.3	4.0 $\pm$ 0.1
Normospermic ( $n = 17$ )	I-SCD	3.4 $\pm$ 0.2	208.4 $\pm$ 36.2	60.2 $\pm$ 2.4	3.0 $\pm$ 0.1	52.7 $\pm$ 3.4	66.1 $\pm$ 3.8
	MAST	2.7 $\pm$ 0.2	139.5 $\pm$ 27.0	55.0 $\pm$ 2.8	2.7 $\pm$ 0.1	50.8 $\pm$ 3.3	39.0 $\pm$ 2.6

<sup>a</sup>Values are mean  $\pm$  SEM. Significant differences ( $P < 0.05$ ) in all semen parameters were assessed between ejaculate production methods within each patient group (no difference in morphological features within normospermic group).

TFSF = total functional sperm fraction.

### Sperm retrieval from morning urine

The idea of sperm collection from centrifuged morning urine is applicable to adolescents, in whom the onset of spermatogenesis has to be assessed, and in paraplegic men with intact spermatogenesis. In both cases, the underlying idea is that there may be a 'passive' overflow of seminal fluid containing spermatozoa from the seminal vesicles into the prostatic urethra.

Spermaturia has been shown to be present in an increasing percentage of schoolboys, from 1–2% at 11 years to 15–37% at 12–13 years and 24–69% at 14 years (Richardson and Short, 1978; Hirsch *et al.*, 1985). Spermatogenesis has been found to occur on average at 13.4 (range 11.7–15.3) years and is accompanied by a wide range of other clinical characteristics of the onset of puberty (Nielsen *et al.*, 1986); moreover, spermatogenesis is also related to gonadotrophin excretion (Kulin *et al.*, 1989). Of interest, it may precede 'conscious' ejaculatory activity. Direct examination of semen specimens has shown that azoospermia is frequent during early ejaculations, motile spermatozoa becoming present in the ejaculate progressively. Normal sperm characteristics are the standard in boys aged 17 years onwards (Janczewski and Bablok, 1985a,b). These findings suggest also that in paraplegic men, some spermatozoa may be present in morning urine.

To date, no data have been published where spermatozoa recovered from morning urine of paraplegic men have been used in order to obtain a pregnancy. Most of these men are treated by vibro- or electrostimulation or by testicular sperm extraction (TESE)/ICSI.

### Sperm retrieval from post-masturbation voiding specimens

Another group of patients in whom sperm retrieval from urine is possible are those who present with retrograde ejaculation. An overview of possible treatments in this condition has been given in an earlier case report (Gerris *et al.*, 1994).

Retrograde ejaculation is an uncommon cause of infertility, but the most common cause of an absent ejaculate. Its aetiology may be either congenital or acquired. In congenital cases, the patient has never produced an antegrade ejaculate. This may be due to congenital anomalies, e.g. ectopic ejaculatory ducts opening near the bladder neck or in the ureters, bladder neck anomalies or distortions due to ectopic ureters; it may also be present in spina bifida or gross abnormalities of the perineal structures, e.g. extrophy of the bladder requiring specific treatment approaches. Acquired retrograde ejaculation is much more common. In a number of patients, no clear cause for the condition can be found, even after extensive investigation. These cases are thought to be due to a progressive widening of the bladder neck, allowing the passage of spermatozoa especially when the bladder is empty. The most common causes of acquired retrograde ejaculation are prostatectomy and both insulin-dependent and non-dependent diabetic neuropathy. Infrequent causes are multiple sclerosis, abdominoperineal rectal surgery, retroperitoneal lymphadenectomy, lumbar ganglionectomy, aorto-iliac surgery and ileal J-pouch–anal restorative proctocolectomy.

From the point of view of infertility treatment, there are three treatment options. First, drugs may be administered which may

or may not result in (partial) anterograde ejaculation obtained after masturbation. Drugs which have been used are imipramine (25 mg t.i.d.), brompheniramine maleate (8 mg b.i.d.), ephedrine hydrochloride and clomipramine hydrochloride. However, results are unpredictable (Eppel and Berzin, 1984). Second, one may retrieve spermatozoa surgically from the testes, epididymes or vasa deferentia, but this approach is rather aggressive. In most cases, however, it is possible to obtain viable spermatozoa from urine voided immediately after (retrograde) masturbation. To this purpose, urine is alkalinized by administration of 4×1 g/day sodium bicarbonate in water for several days before the sample collection. Even if very few spermatozoa are obtained from this urine sample, ICSI will usually be possible.

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