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Sperm motility index and it's relation to sperm concentration in subjects with impaired fertility potential

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Abstract

A cross sectional study of sperm motility index (SMI) in normozoospermic and oligoasthenoteratozoospermic males was undertaken to find correlation between sperm concentration and SMI. Two-hundred subjects with impaired fertility potential were screened for the routine seminogram parameters along with SMI using sperm quality analyzer (SQA IIB) to find out the SMI in the population of central India and were divided into normozoospermia and oligoasthenoteratozoospermia (OAT). The SMI in the normozoospermic group was 290 ±106.93 and in OAT group it was 55 ±26.02 (P<0.05). In conclusion, SMI has progressive linear relation with sperm concentration (coefficient of correlation 0.94)

Key words: Sperm motility index (SMI), Sperm concentration, Fertility potential

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Introduction

Sperm motility is one of the most important parameters in evaluating the fertility potential of a semen specimen. A man with completely immotile sperm is sterile as immotile sperm whether living or dead cannot penetrate cervical mucus [1]. Sperm motility index (SMI) takes into account all the parameters of semen analysis and integrates them into a single objective numerical value, which reflects the comprehensive overall status of semen and its fertilization potential. The SMI has the sensitivity of 93%-96% and specificity of 84%-85 and 5% in ruling out the oligozoospermic from asthenozoospermic semen samples [2].

Material and Methods

Semen samples were obtained from the male partners of the couples with impaired fertility potential attending the Reproductive Biology Unit, Department of Physiology, MGIMS, Sevagram. Study was conducted during the period from April 2002 to February 2004. Subjects having azoospermia, necrospermia and genital tract infection (based on semen culture and sensitivity) were excluded from the study.

Study Design

Total numbers of subjects studied were 200 between the ages 19 to 58 years with the mean age of 31 years. Persons without hydrocoele, varicocele, undescended testes or atrophied testes were included. Subjects were classified into two groups based on their semen analysis findings viz. normozoospermic and oligoasthenoteratozoospermia group [3].

The normozoospermic group had sperm concentration of 20 million spermatozoa or more per mL of semen with more than or equal to 25% grade A (4+) motility or more than or equal to 50% grade A (4+) + B (3+) motility and normal morphology of more than or equal to 30% normal head forms. The oligoasthenoteratozoospermia group had sperm concentration less than 20 million/mL of semen with less than 25% grade A motility and normal sperm morphology less than 30%.

Collection of Semen

Semen samples were collected in dry, wide mouthed glass containers. Patients were asked to observe 3 days absolute abstinence and semen obtained by masturbation or coitus

interruptus method. Patients were advised not to use condoms since they may contain a spermicide.

Semen samples so obtained were analyzed for following parameters: 1. Volume; 2. pH; 3. Sperm concentration; 4. Sperm motility; 5. Sperm motility index (SMI)

Sperm concentration

The sperm concentration was evaluated by Sperm Quality Analyzer (SQA-IIB) at the room temperature [2].

Sperm motility and sperm motility index (SMI)

The percentage of motility and sperm motility index (SMI) was evaluated by Sperm Quality Analyzer (SQA-IIB) at the room temperature [2].

To evaluate grade of motility at least 5 µL (diluted if concentration of the sperm is greater than 60 million/mL.) of semen was placed on a standard microscopic slide, a cover slip was placed over the drop and under high power objective number of motile sperms per field was counted.

The quality of sperm motility was graded on a scale of 0 to 4 as follows [4].

0: No motility; 1(+): Sluggish activity, minimal forward progression; 2(++): Poor to fair motility; 3(+++): Good motility with tail movements visualized; 4 (++++): Excellent forward progression, tail movements difficult to visualize.

Observations and Results

During this study 200 semen samples were analyzed. Out of these 100 were normal and 100 were abnormal. The mean age of the subjects studied was 31 years and the range was 19 to 58 years.

The distribution of sperm count, in both the groups is shown in Table I. In normozoospermic group, mean sperm count was 108 $\pm$ 34.29 million/mL and in oligoasthenoteratozoospermic (OAT) group, the count was 18 $\pm$ 12.62 million/mL (Fig. I.)

In normozoospermic group, sperm motility was 60% $\pm$ 9.17% and in oligoasthenoteratozoospermic (OAT) group, the motility was found to be 21% $\pm$ 9.08% (Fig. II).

The SMI in the normozoospermic group was 290 $\pm$106.93 and in OAT group it was 55 $\pm$26.02($P<0.05$) [Fig. III] There appears to be a linear relationship between the sperm concentration per mL of semen and the sperm motility index (SMI) [Coefficient of correlation (*r*) 0.94] (Fig. IV) and between the sperm motility and SMI (Fig. V).

Table I: Showing sperm count, percent motility and sperm motility index (SMI) in normozoospermic group and OAT group.

Groups	Sperm Count (million/mL)	Percent Motility	SMI
Normozoospermic (100)	108 $\pm$ 34.29	60 $\pm$ 9.18	290* $\pm$106.93
Oligoasthenoteratozoospermic (OAT) (100)	18 $\pm$12.62	21 $\pm$ 9.08	55 $\pm$26.02

Values are Mean $\pm$ SD.
Figures in parentheses indicates number of subjects
**P <0.05*

Fig. I. Comparision of Sperm Concentration (million/mL) In Normozoospermic and OAT

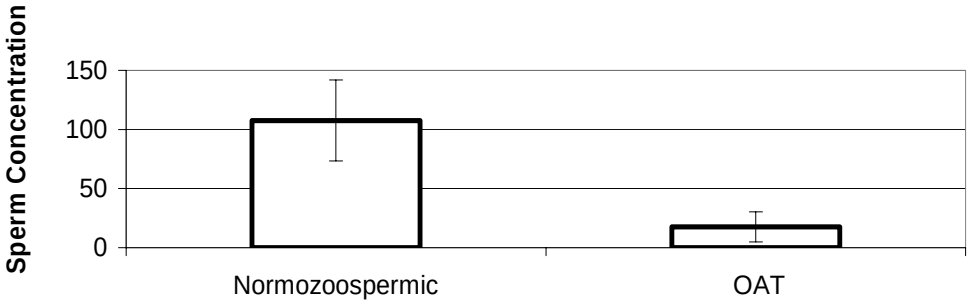


Fig. II. Comparision of Percent Motility In Normozoospermic and OAT

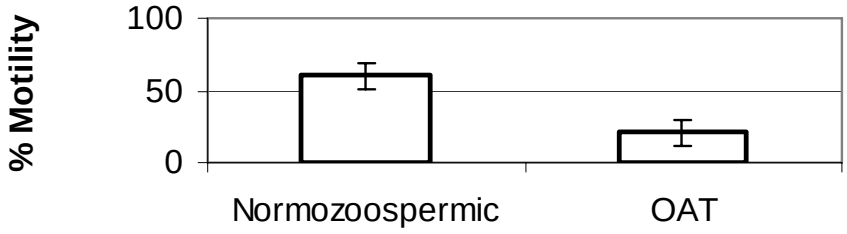


Fig. III. Comparision of Sperm Motility Index (SMI) In Normozoospermic and OAT

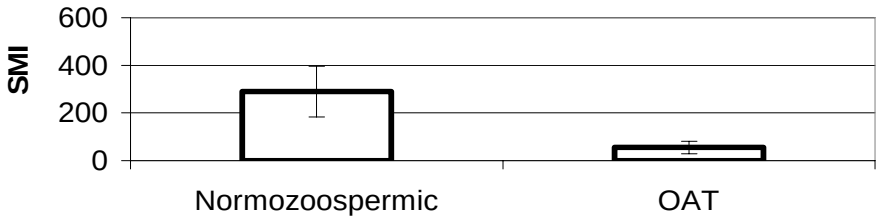


Fig. IV. Relationship Between Sperm Concentration and SMI

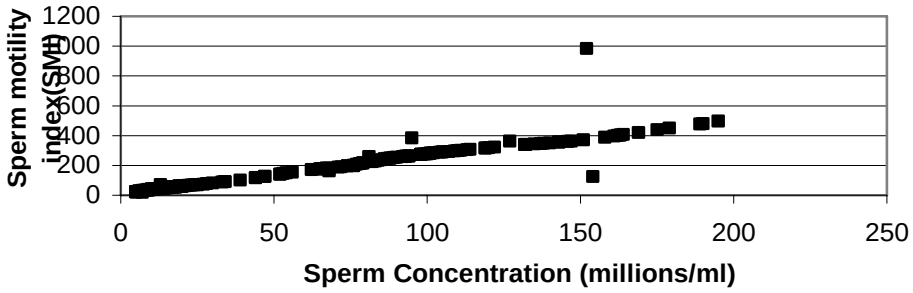
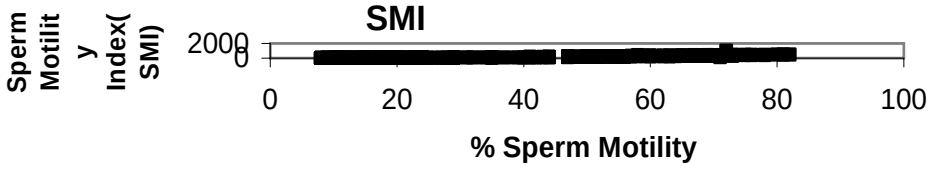


Fig. V. Relationship Between % Sperm Motility and SMI



Discussion

The mean sperm concentration found in this study was 108 ± 34.3 million/mL in case of normozoospermic and 18 ± 12.6 in the OAT group ($P<0.05$). The acceptable sperm count levels in terms of potential fertility are 20 million/mL and there is no linear relationship between the count and actual fertility. According to the committee of International Fertility Association (evaluation of criteria for fertility), lower limit of fertile range has been dropped from 60 million/mL to 20 million/mL. Counts of less than 20 million/mL is usually considered to be distinctly abnormal, although successful impregnation may occur [5]. It is gener-

ally accepted that sperm count alone cannot be considered the major determinant of a man's infertility and that fertility potential is related to the number of motile sperm.

There was significant variation found in the percentage motile sperms in two different groups in this study. In the normozoospermic group, it was 60 $\pm$ 9.17 % and in OAT group it was 21 $\pm$ 9.02% ($P<0.05$). The results were compatible with the study of Rehan *et al*. [6] who reported that each of the 25 men in whom the sperm density was less than 10 million/mL had fathered 2 or more children. This study showed definite positive relationship between sperm density and percentage of motile sperm. A relationship was also found between sperm density and grade of motility. But according to some authors very high counts over 300 million/mL can result in reduced fertility through reduced sperm motility [7]. But in the present study we didn't encounter the sperm density as high as that of 300 million/mL, the maximum sperm density was 195 million/mL. Type of movement also influences fertilizing capacity [8]. Sperms swimming in tight circles cannot readily pass through the uterotubal junction and only straight swimmers succeed in fertilizing ova. Thus the wives of men who have greater active sperm count in the ejaculate conceived, sperm motility compensated for the low sperm count levels in the fertile group [9]. A man with completely immotile sperm is sterile. Immotile sperm whether living or dead cannot penetrate cervical mucus [1]. In this study the SMI in the normozoospermic group was 290 $\pm$106.93 and in OAT group it was 55 $\pm$26.02 ($P<0.001$). The SMI has progressive linear relation with sperm concentration (coefficient of correlation 0.94) [Fig. IV], percent motility (coefficient of correlation 0.92) [Fig. V].

Conclusion

SMI showed a positive correlation with sperm concentration.

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