Non-systemic, Non-hormonal Forms of Male Contraceptives

Traditionally women have been responsible for prevention of pregnancy. With the common misconception that inhibition of one egg per month is a much easier goal than millions of sperm. Many options are available to women on the market today from hormonal manipulation to timed abstinence and barrier methods. However, only two options remain available for the sexually responsible male, condoms and vasectomy. There is a growing desire for this to change. More men want to take part in contraceptive responsibilities and thus more research has been focused on contraceptives for men. A desire to have more control over career and life planning as well as contraceptive complications for female partners are a couple of the prevalent drivers for this new demand for alternative options.

Popular female contraceptive methods have involved hormone manipulation. This method uses exogenous hormones to “trick” the female body into thinking that it is pregnant which prevents ovulation and eliminates opportunity for pregnancy (Senger P. 2003). However, over the years complications due to female hormonal birth control methods include weight gain, moodiness, nausea, headaches, depression, loss of libido, and menstrual problems (Thompson, 2006). Similar hormonal methods are being researched for the male. However, men may consider these side effects unacceptable and lose interest in using them, especially when they can divert the responsibility, and side effects, to women who have already accepted the undesirable effects as commonplace. There are also many consequences of female hormonal contraceptives that we don’t fully understand and to duplicate these potential problems for men may be foolish.
In light of recent allegations of yet more female hormonal contraceptive complications some researchers have focused on non-hormonal but still systemic methods of male contraception. These are pharmaceuticals that are directed at interrupting processes like spermatogenesis, sperm transport or zona binding ability. Though hormones are not involved, these medications are distributed throughout the body and may affect non-targeted areas, which could cause unintended consequences (MCIP 2006).

These and many more reasons have influenced some researchers to developing non-hormonal, non-systemic approaches to male contraception. These methods are focused on manipulating only the targeted reproductive area, testis, and affecting only this desired body system. Emphasis in research is placed on reversibility providing men with the option to have children in the future. The methods discussed below are still being developed and are not currently available, except in trial situations.

**Heat Based Methods**

In the cattle industry it is well know that the cooling efficiency of a bulls testis is correlated to reproductive success. For spermatogenesis to occur the testis must be 4-6\(^0\) C cooler than the body. This is achieved by counter current heat exchange in the vascular cone, complementary temperature gradients in the scrotum and testis, scrotal sweating as well as distancing the testis from the body. Bulls with abnormal heat distribution have poor semen quality (Kastelic, 2006). These same principals hold true for the human male. Many fertility complications are quickly solved with a prescription for loose underwear and hot tub abstinence. Researchers are trying to build off of this principal. By creating a
hot testicular environment a poor spermatogenic environment is generated, promoting infertility.

**Suspensitories**

Suspensitories are underwear that increase the temperature of the testes by holding them close to the body, causing infertility. From the outside they look like a normal pair of underwear but they simulate a condition called cryptorchidism, where testes fail to descend through the inguinal cavity at birth. Patients with this condition are usually infertile because the testis cannot reach a cool enough temperature (MCIP 2006). Some underwear styles leave the penis and scrotum free but all styles hold the testis in the lower ends of the inguinal cavity. The underwear must be worn daily for at least two months to have any effect on fertility. The time frame to infertility (decrease in sperm count and motility) ranges between individuals. Some studies show infertility from 2 to 9 months (Thompson, 2006). Some men find the underwear uncomfortable but most don’t notice them (MCIP 2006).

Reversal is successful after treatment stops. Sperm counts and motility numbers return to pretreatment levels within 12-18 month after a 1-year treatment (MCIP 2006). However, full recovery is not necessary for successful fertility and pregnancy may be achieved well before full recovery. There has been no permanent infertility associated with this method (Thompson, 2006).
**External Heat**

External heat draws on the same principals as suspensitories but uses a different method of heating the testis. External heat methods also cause testes to be heated much higher than body temperature, so duration of treatment is reduced (Thompson, 2006).

Water is one external method used to heat the testes in the form of a hot tub or type of bath where only the testes are submerged. It is suggested that a 116°F, 45-minute bath taken for 21 days in a row will result in infertility for 4-8 months and treatment can be repeated or maintained to continue infertility (Thompson, 2006). By comparison a very hot bath is 105°F, the pain threshold for adults is 118°F and the temperature required to burn a child in 2 minutes is 125°F. This may lead one to believe that the bath would be painful or uncomfortable (MCIP 2006). However, because the heat is quickly being absorbed by the body and removed from the skin, many men find it rather pleasant.

Like the concept of an electronic heating blanket, battery powered pouches have also been developed to deliver electronic heat to the testes. Using the pouch for 0.5-2 hours for 7 weeks is suggested to result in infertility (Thompson, 2006). Pouches may be a more realistic approach for the active male who does not have 45 minutes to devote to a bath for 21 consecutive days.

All heat-based methods show excellent reversibility and fertility returns within 2-6 months for men that stop treatments (Thompson, 2006). In theory treatments that exceed recommended temperatures could result in permanent damage. However, the pain associated with those temperatures would not be physically tolerable for long enough to cause permanent infertility.
**Ultrasound**

For ultrasound contraception, ultrasound waves (very short, inaudible sound waves) are used to heat the testes. The testes are placed into a cup of water in which an ultrasound element is placed. The element makes the environment intolerable for sperm production by heating the water and also by possibly creating an ion exchange between the fluid in the rete testes and the seminiferous tubules (MCIP 2006). Applying ultrasound to the testes for 10 minutes once every 6 months brings about azoospermia. (Lissner E. 1992). Fertility will gradually return with treatment suspension. However, more research is required to determine the effects of long-term treatment.

**Vas Deferens Manipulation**

In order for sperm to exit the penile urethra, they must first travel from the testis. Vas deferens are the conduit through which sperm are transferred from the caudal epididymus of each testis to the penis. It seems obvious that preventing the sperm from passing through this conduit or disabling them as they pass through would be an effective way to cause infertility.

**Vasectomy**

A vasectomy involves a simple procedure where a qualified physician isolates the vas deferens then cuts and cauterizes them. This disables the transport mechanism and sperm are halted at the point of severance. This method has been effective but reversibility of this procedure is generally not guaranteed. Therefore this method is not
suitable for males who only wish to postpone pregnancy. In light of this other methods are being developed with the same principal in mind but with better reversibility.

**Plugs**

**Intra vas devices (IVD)** and **injectable plugs** both function by trying to block the sperm from passing through the vas deferens to the penis. IVD consists of preformed silicone plugs that are implanted in each vas deferens. Two or three are usually implanted on each side, as a safety mechanism, to catch any sperm that were not stopped by the previous plug (MCIP 2006). Removing the plugs to restore sperm passage is much easier than reversing a vasectomy. However, over time vas deferens can rupture due to a build up of sperm at the blockages, causing a decrease in the chance of reversal success.

Injectable plugs work the same as IVDs but eliminate the stigmatism of surgery. Each vas deferens is clamped in two places and a polymer is injected into the lumen of the vas deferens, between the two clamps. The liquid polymer hardens in place forming a plug and the clamps are removed (Thompson, 2006). Sperm disappearance seems to take longer than vasectomy with this method and when researchers investigated the reason for this delay they discovered that the vas deferens were rupturing at the site of injection (allowing passage) and azoospermia was only achieved after the material and a mass of scar tissue had formed at the site, successfully blocking passage (MCIP 2006).

**RISUG**

RISUG is an acronym for Reversible Inhibition of Sperm Under Guidance. RISUG works in two ways to cause infertility. By partially blocking the sperm in the vas
deferens and also by disabling the sperm that actually pass through it. The process consists of injecting a liquid compound; composed of styrene maleic anhydride (SMA) mixed with dimethyl sulfoxide (DMSO), into the vas deferens in much the same manner as the injectable plugs (MCIP 2006). The compound coats the walls of the vas deferens and hardens, anchoring itself to the walls of the vas deferens, within a few minutes. The compound not only acts as an obstruction to the passage of sperm but it also physiologically compromises the sperm that do pass through it. It is believed that the compound stresses the sperm’s Ion exchange mechanisms, causing the sperm’s outer membrane to rupture. The sperm’s outer membrane is essential for fertilization as it contains special enzymes that enable the sperm to attach to the egg and also to dissolve the eggs outer membrane (zona pellucida) providing entrance for fertilization (Senger P. 2003). Without these special enzymes there is no chance of conception.

The procedure is fast acting and men are told to not have sex for three days after the injection, to allow the compound to fully anchor, and to use back up birth control for the first 10 days (Thompson, 2006). This is an incredibly short time frame in comparison to a wait of up to three months for full infertility with a vasectomy.

The most promising aspect of this product is its simple reversibility. Whenever the man chooses, a simple solution is injected into the vas deferens, it dissolves the compound and everything is flushed out of the system. Removal can also occur with massage, vibration and low electrical current. Injection and reversal have been done many times in monkeys with no problem. Preliminary studies on primates showed normal sperm levels within 2-3 months of reversal. However, long term studies have yet to be
preformed. Approval for use of RISUG in India is in phase three of clinical trials (Thompson, 2006).

These examples are only a handful of the many research projects that are focused on providing another choice for the sexually responsible person. With advances in new male contraceptives many unnecessary evils could be avoided. The population is rising at a remarkable rate, especially in third world countries where condoms and/or the pill are not available or too expensive. A long term, affordable, reversible, hassle free form of birth control could prevent unnecessary death and suffering in developing countries. However, economically challenged countries are not the only ones that would benefit from improved contraceptives. Abortion rates, especially in teenagers, are still high in wealthy countries like the United States; and current contraception methods are not acceptable for some cultures and religions (MCIP 2006). Millions of dollars are spent every year in social assistance supporting unwanted children and young mothers who do not have the means to support the consequences of an uneducated decision.

Despite the overwhelming need for progress in this area, researchers have many roadblocks and hurdles to overcome. Funding from the government is limited due to the position that more urgent research for ailments like cancer and AIDS take precedence for funding dollars. Research involving non-pharmaceutical based male contraceptives with slight profit potential has little support from the private sector pharmaceutical companies for obvious reasons (MCIP 2006). However, even male pharmaceutical based methods are not much more successful in attaining funding as this would cause a reduction in female intake of the birth control pill. Essentially, why would companies spend millions
of dollars on development of male birth control, to sustain the same profit margin they are already guaranteed with female birth control?

The obvious question is; what can we do to ensure that these logical approaches to birth control are researched and developed to provide the safest options for the greater good? Spread the word, inform people about the potential for these new ideas. Let the government know that if there is a better way it should be explored, developed and available to the public regardless of poor profit margins for the currently wealthy pharmaceutical companies. There will be no supply with out first creating a demand for it!

References


MCIP 2006 Male Contraception Information Project