**Contraception. What is new?**

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**Abstract**

**Introduction:** In this review, we discuss three main points: 1. What are the main achievements of modern contraception? 2. What could be done better? 3. Contraception in the future.

In Part I we present all-new achievements in contraception including WHO data. It is essential, that, family planning/contraception reduces the rate of artificial abortion, especially unsafe abortion. Meantime we are aware, that the ideal contraceptive does not exist yet and the activities for its creation is going on. We suppose that a lot could be done better. For instance: it is lack of male contraception, Mifepristone successfully can substitute any type progestogene in female and male hormonal contraceptives. Also "The Modification of the Method of Hormonal Contraception" (MHC) gives the possibility of 80% decrease in the frequency of side effects of the combined oral contraceptives and the "Phasic" contraceptives is considered as a huge additional benefit of the hormonal contraception. Contraception in the future should be based on something principally new. It is impossible to say how achievable the goal is, but still, we would like to present some of our promising options of female and male contraceptives for the future such as the fertility chip, origami female condom, dapavirine vaginal ring, vazalgel, gamendazole, clean sheet pill.

**Method:** The data concerning the issue was collected from the Google, NCBI, and PubMed database by the use of keywords, such as: family planning, modern contraception, male contraception, emergency contraception, hormonal contraception, mifepristone, the future of contraception. The years for search were 1989-2018.

**Conclusion:** The combat for the ideal contraception is continuing. It is necessary to develop the male contraceptives and bring it up to the level of the females. Female contraception requires not only new methods but also, more appropriate use of already existing ones. The mechanism of action of the future contraceptives should be based, not only on biological, but physical and chemical processes as well. *(TCM-GMJ April 2020; 5(1):P7-P10)*

**Keywords:** Family planning; Modern contraception; Male contraception; Emergency contraception; Hormonal contraception; Mifepristone; Future of contraception.

**Introduction**

It is obvious today, that the problem of contraception has passed the medicine and received a manifested social tinge. Currently, it seems to be the only effective mean of monitoring the uncontrolled birth process in the World. For a long time, we have been seeing the need for official recognition of family planning and contraception as the main possibility of liquidation of uncontrolled birth rate and simultaneous influence on the processes by developed countries, international, intergovernmental, and non-governmental organizations.

In this review, we would like to focus on three main points: 1. What are the main achievements of modern contraception? 2. What could be done better? 3. Contraception in the future.

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**What are the main achievements of modern contraception**

Some main non-medical facts should be noted about contraception: 214 million women of reproductive age in developing countries, who want to avoid pregnancy, are not using a modern contraceptive method (1). In addition, some family planning methods, such as condoms, help prevent the transmission of Human Immunodeficiency Virus (HIV) and other sexually transmitted infections (STIs) (2). It is essential, that, family planning/contraception reduces the rate of artificial abortion, especially unsafe abortion (3). Family planning reinforces people’s rights to determine the number and spacing of their children. Finally, by preventing unintended pregnancy, family planning/contraception prevents mothers and children mortality (4).

It is important that family planning is widely available and easily accessible through midwives and other trained health workers, to anyone who is sexually active, including adolescents. Midwives are trained to provide locally available and culturally acceptable contraceptive methods.

Nowadays, there is a huge number of ways to prevent
unintended pregnancy. Each method has its own advantages and disadvantages. When choosing the safest contraceptive the patient should receive the following information: the effectiveness of the method, the probability of pregnancy, rules for using contraception, mechanism of action, adverse effects, possible health risks, degree of protection of the method against STIs, symptoms requiring medical attention, restoration of fertility, if desired. In table 1 is listed the effectiveness of each contraceptive method and additional benefits.

It should be noted in reality, that the birth control methods mentioned above give us the possibilities for individual selection of adequate modern contraceptives for practically all types of patients, with the guaranty to plan the pregnancies without any serious complications.

We consider that a lot could be done better. This is the point of this part, which rests on the 52 years’ experience in clinical and theoretical contraception.

First of all, it is not good, that among the nineteen modern methods of contraception mentioned above, only three are for males. It is not so easy to answer the question “Why?” The practice showed us, that creation of one of the most modern male contraception methods - hormonal - is justified and is already created, but not used in reality. Maybe the reason is that both, creators and the interested in the contraceptives business are all men? We cannot be sure; we have to face the fact.

In 2017 Doctor Colin Tidy has mentioned, that the potential male pills have been studied for many years but concerns over side effects have meant there still is not one available (5). However, there are different opinions, as to why male contraception has not advanced beyond the two options: condoms and vasectomy. One leading scientist in contraception, Carl Djerassi blamed a lack of priority given by the pharmaceutical companies and believed a male pill would never be available for political and economic reasons, in an interview with the Independent (6).

It should be noted, that in the early 80th of the last century, a French Biologist Etienne Emile Baulieu has introduced the unique compound - Mifepristone, which was used for first trimester pregnancy termination (7, 8). Currently, Mifepristone is widely used for many purposes including contraception (figure 1). WHO has carried out the study and approved small doses of Mifepristone for post-coital contraception, but it is not brought down to practice (9, 10, 11). Also, it is the matter of the fact, that Mifepristine easily and successfully can substitute any type of modern female and male hormonal progestogen containing contraceptives.

We invented, patented, and used “The Modification of the Method of Hormonal Contraception” quite widely in Georgia for the women with the duration of menstrual cycles different than 28 days (approximately 40% of women). The modification gives the possibility of 80% decrease in the frequency of side effects of the combined oral contraceptives (12). In figure 2 the possible schemes of modifications are represented.

Finally, the most common method of preventing pregnancy in the world is hormonal contraception. The classification of contraceptives divides the hormonal drugs into combined and containing progestin only. Combined drugs contain estrogen and progesterone components. Depending on the concentration of substances in the drug varies: monophasic, two-, three- and four-phase contraception. In the 70-80th of the last century, the “Phasic” contraceptives were created by prominent Western scientists and manufactured by the biggest pharmaceutical companies. The phasic hormonal contraceptives will create an amazing future, especially for the “elite” contraception, and even more, for their therapeutic possibilities. The last-mentioned method is considered as a huge additional benefit of the hormonal contraception. These drugs have also therapeutic effects and non-contraceptive indications, such as bleedings and irregular cycles, endometriosis, fibroids, dysmenorrheal, premenstrual syndrome, ovarian cysts, acne, hirsutism, PCOS (13, 14, 15). It is very regretful, that the wide promotion of the phasic hormonal contraceptives was not brought to reality.

**Contraception in future**

Needless to say, that the contraception futurology cannot be based on the mistakes only. It should be based on the something principally new. We have something theoretically and practically interesting in the special literature. Some of them are under the clinical trials and majority of them are of high ideological quality. It is reasonable to start from the male contraception futurology.

**Male Hormonal Contraceptives**

Khourdaji et al., are considering testosterone should remained as the basis of male contraceptives, but comparatively low rate of aozoospermia in Caucasian men with androgen-only regimens (16, 17, 18). Scientists have explored the additional of progestins to further enhance the efficacy of hormonal contraception (19). Studies have revealed promise with androgen-progesterin regiments, the lack of long-term studies has precluded the development of a marketable product. Recently, more research has been directed towards identifying non-hormonal alternatives to male contraception. These non-hormonal options vary from the development of devices facilitating reversible occlusion of the vas deferens lumen to medications disrupting various pathways in the process of spermatogene-

**Vasalgel** is a polymer gel that is injected into the vas deferens (20). Vasalgel is being developed as a long-acting, non-hormonal contraceptive with a significant advantage
over vasectomy, it is likely to be more reversible. The procedure is similar to a no-scalpel vasectomy, except a gel is injected into the vas deferens, rather than cutting the vas (as is done in vasectomy). If a man wishes to restore flow of sperm, whether after months or years, the polymer would be dissolved and flushed out. Clinical trials are expected to begin in the near future (21).

**Gamendazole** (indazole carboxylic acid) is a potential alternative for a male pill. It works by interfering with sperm production without affecting testosterone levels. Animal studies have shown promising results and further safety trials are due in the near future (22). The effect of Gamendazole is reversible eight-to-ten weeks after the drug is stopped. Further research must be done to establish if Gamendazole can affect a women’s body, and if the drug is awaiting pre-clinical safety and efficacy trials (23).

**The Clean Sheets Pill** is a hormone-free method that works by relaxing the muscles, which creates lengthwise contractions along the vas deferens, meaning man can still achieve orgasm, but the release of semen is inhibited. Not only is the pill, which can be taken in single doses, promising pregnancy prevention, but it also stands to reduce the risk of transmitting HIV, which makes it useful for the gay community as well. The Clean Sheets pill has shown promising results in animal studies, but due to lack of funding, the research has been unable to progress further (24).

There are other potential male pills at various stages of research and development. Other examples include Gendarussa (a non-hormonal pill derived from the plant Justicia gendarussa) and Eppin (epididymal protease inhibitor) (25, 26).

Another area of research is the development of a vaccine that would provide contraception by attacking certain chemical targets in the human reproductive system. The contraceptive vaccines lead to the generation of a humoral and/or cell-mediated immune response against antigens that has a critical role to play in the reproductive process (27). These vaccines can be designed to inhibit the production of gametes (spermatozoa and oocyte), functions of gametes (obstructing fertilization), and the gamete outcome (pregnancy) (28). The main targets so far have been the hormone follicle-stimulating hormone in men and the hormone human chorionic gonadotropin in women. The vaccines wear off after about one year. So far, contraceptive vaccines have not been shown to be effective and there are concerns about side effects (29). However, work continues and vaccines may become an option in the future.

**Female Contraception today and tomorrow**

We can be satisfied by the current level of female contraception, because, as mentioned above, it is giving the possibility to meet the demands of the majority of the World’s population appropriate with ethnic, religious, and health status peculiarities. But better social and informative adaptation of the bigger numbers of the population by the improvement of their accessibility is necessary. The combat for the better contraception is continuing. It is impossible to say how achievable the goal is, but still, we would like to present some of our promising options for female contraceptives for the future.

**The Fertility Chip**

In 2014, the Bill and Melinda Gates Foundation funded the development of a new type of implant birth control that could revolutionize the field of contraceptives (30). Called the “Fertility Chip,” The device is a tiny microchip inserted under the skin that would release levonorgestrel over the course of sixteen years, longer than any other form of birth control on the market. The “clip” seems very promising for other drugs, by the way (31).

**Origami Female Condom**

The female condom is certainly not new, but designer Daniel Resnic wants to reinvent it. Female condoms have long been maligned for being difficult to insert, hard to source, and subject to the usual complaint male condoms receive, i.e. that they decrease sensation. The Origami female condom, however, is oval-shaped to mimic female anatomy, it only expands once inserted and is pre-lubricated with a silicone-based lubricant. The product is still being studied clinically (32).

**Dapivirine Vaginal Ring**

While the vaginal ring is not used for the prevention of pregnancy, it is still an extremely promising product, because it has been found up to 61% effective at preventing the transmission of HIV (33). No current products on the market exist to prevent HIV, so the vaginal ring has huge implications. The Ring works by releasing a small amount of dapivirine, which prevents the HIV virus from making copies. Clinical studies showed a general risk reduction level of 37%, but when the results included only women aged 25 and up, the device showed 61% efficacy. The Ring is currently still in the testing process (34).

These are only a few variants of female contraceptives for the future. We have some other options as well. The Georgian Association of Reproductive Health and the Zhordania Institute of Reproductology have their plans of contraception in the future, which is based on utilization of electromagnetic waves and it is on the experimental stage.

**Conclusion**

The combat for the ideal contraception is continuing. It is necessary to develop the male contraceptives and bring it up to the level of the females. Female contraception requires not only new methods, but also, more appropriate use of already existing ones. The mode of action of the future contraceptives should be based, not only on
biological, but physical and chemical processes as well.

Conflict of interest disclosure

The authors declare that they have no conflict of interest regarding the publication of this article.

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