

Modafinil and Its Effects on Student Life

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Abstract— The “smart drug” Modafinil, also known as Provigil, is approved by the Food and Drug Administration to treat people who are suffering from sleep disorders such as narcolepsy. This drug promises to increase users' waking hours without sacrificing the clarity of thought and without serious side effects. Impelled by this, students use it off-label to stay focused for longer periods of time than usual while studying for exams. It is believed that the Modafinil has the ability to increase the attention span and alertness, too.

Keywords—Modafinil, Provigil, smart drug, nootropic, positive effects, side effects

I. INTRODUCTION

Modafinil is a medication used to treat excessive sleepiness due to narcolepsy, shift work sleep disorder, or obstructive sleep apnea [1].

Due to its effects, Modafinil has emerged as one of the most popular “smart drugs”, promising enhanced memory, laser-like focus, and motivation, all for hours at a time.

It has been reported that one fifth of university students in the United Kingdom have used Modafinil at some point in their life [3]. Using the so-called “smart drugs” students aim to boost their grades, therefore raising the question of ethics. Professor Barbara Sahakian, at the University of Cambridge, who has been researching Modafinil as a possible clinical treatment for the cognitive problems of patients with psychosis, raises the same question. Living in an increasingly competitive world, people are always looking to gain an advantage over their rivals, sometimes even their own colleagues. In some cases, it can push people to extreme, unethical and illegitimate methods – something seen recently in the doping scandal that has hit the athletics world [4][5].

It is known that work-related stress, performance over long hours, lack of sleep, shift work, and jet-lag affect cognitive functions. Therefore, an increasing number of healthy people are reported to use cognitive-enhancing drugs, as well as other interventions, such as noninvasive brain stimulation, to maintain or improve work performance [6]. For this reason, cognitive enhancing drugs have been used for many years by students, military people and in some cases even by doctors.

II. MODAFINIL USES

The Food and Drug Administration (FDA or USFDA) is a federal agency of the United States Department of Health and Human Services, responsible for protecting and promoting public health through the control and supervision of prescription and over-the-counter pharmaceutical drugs (medications), among others.

The FDA has approved uses for Modafinil to treat the following medical conditions: narcolepsy, obstructive sleep apnea, and shift work sleep disorder. But as many other drugs, Modafinil is often used off-label for uses that are not approved by the FDA. Using it off-label means that the drug has been approved for one use, but is used for another. To this day, Modafinil has been used off-label to treat attention deficit-hyperactivity disorder (ADHD). Although it is not currently recommended by the American Academy of Pediatrics for treating ADHD, some research shows that it can improve symptoms of ADHD [7].

It has been found that Modafinil can improve symptoms of excessive tiredness and fatigue in people who have depression [8]. It has also been shown that Modafinil is effective in treating symptoms of fatigue in people with multiple sclerosis [9].

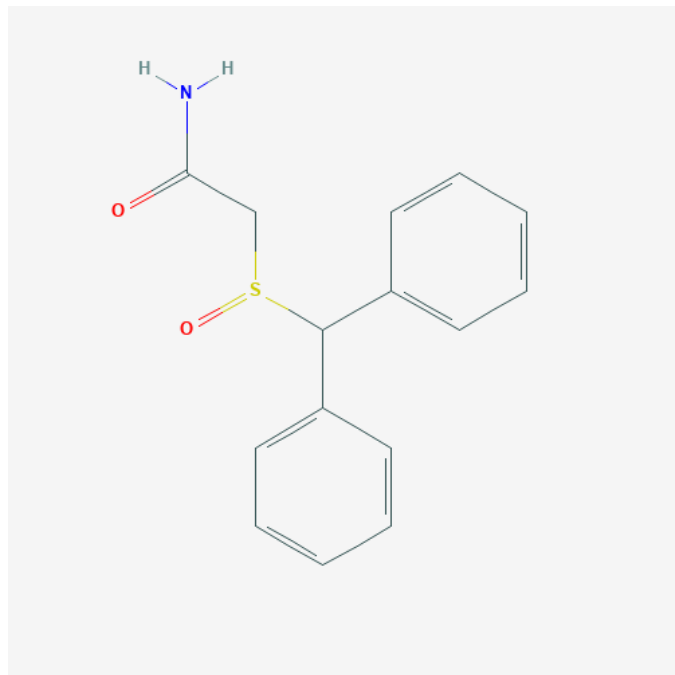


Fig. 1. 2D Chemical Structure of Modafinil [2]

Although Modafinil is sometimes used to treat anxiety and as a weight loss aid, it is believed that it has no direct influence over these. Regarding anxiety, since Modafinil provides more focus, calm, and confidence, many people misuse it as an anxiety aid. Modafinil itself can cause loss of appetite and is therefore misused as a weight loss aid. Doctors strongly advise everyone not to take Modafinil unless your doctor has prescribed it for you, since misusing Modafinil could lead to potential abuse and addiction [10]. The drug has a long history of being used by the military to fight fatigue and to keep pilots awake and provide laser-like focus. As of November 2012, Modafinil is the only drug approved by the United States Air Force as a "go pill" for fatigue management [11].

Not only military people are exposed to high workloads leading to fatigue and stress, but surgeons, too. Since it increases the chances of mistakes during surgery, surgeons have to deal with it using drugs. It has been found that 15% to 20% of surgeons have used drugs for either cognitive or mood enhancement at least once during their lifetimes. Modafinil provides simple pharmacological help for them because it counteracts loss of concentration and fatigue [12].



Fig. 2. Percentage of Students Who Have Used Modafinil by University (United Kingdom) [3]

"Most of us want to reach our true potential. We might drink a cup of coffee to stay awake and alert, or go for a run, to feel on top of the job. So where's the harm in a pill - a "smart drug" - that can do the same thing?" [13]

Students take Modafinil primarily for its ability to increase wakefulness and allow them to concentrate and stay awake for very extended periods of time.

"I was able to write a 22-page paper in one day. I revised it over the next couple of days and got an A. Normally, I wouldn't have even been able to get a rough draft done in a week." [13]

The counterproductive use of Modafinil is often overlooked by students. While some people use the drug on specific occasions - when being jet-lagged or having a particularly bad night's sleep, students take a dose and then, when they start feeling it's wearing off, they simply take another one.

This of course affects their sleep pattern, because the drug prevents them from going to bed and sleep, and therefore from consolidating their memories during sleep, which is counterproductive.

III. SIDE EFFECTS OF MODAFINIL

Along with its needed effects, using Modafinil may cause some unwanted effects. The side effects of using Modafinil may include the following: backache, diarrhea, difficulty sleeping, head pain, nausea, nervousness. The development of adverse reactions is related to higher doses - cardiovascular and central nervous system (CNS) reactions increase significantly after a total daily dose of more than 400 mg. Some side effects of using Modafinil may occur that usually do not need medical attention. These side effects may go away during treatment as patient's body adjusts to the medicine [14].

Although it hasn't been proved that Modafinil produces any functional impairment, any drug affecting the central nervous system (CNS) may alter patient's judgment, thinking or motor skills. Patients should be cautioned about driving a car or other hazardous machinery until they are reasonably certain that Modafinil (Provigil) therapy will not affect their ability to engage in such activities [15].

Some people who take Provigil can have changes in mood or thinking that makes them feel more focused and more confident. Although not common, some people may also experience feelings of euphoria. Some people call this a "high." This effect can lead to misuse or abuse of Provigil for nonmedical uses. Abuse or misuse is more likely to occur in people who have abused alcohol or drugs in the past [16].

In very rare cases, using Modafinil can cause a severe rash within the first few weeks of taking it. It may occur along with vomiting and fever, and may lead to problems with the liver, lungs, kidneys, and heart. Other serious side effects include trouble breathing or swallowing, swelling of lips, tongue, or face. Also for patients with a heart condition or high blood pressure, side effects may reflect in chest pain and pounding heartbeat. Regarding the mental health effects, few people reported that they suffered from depression, confusion and irritability. Although most people don't seem to have withdrawal problems when stopping treatment with Modafinil, some of them who previously had a history of alcohol or drug abuse, may develop psychological and physical dependence [17].

Summarizing the side effects that may come from using Modafinil it is possible to conclude that the drug reactions are different from person to person and are not definite and cannot be predetermined. Positive experience from one patient does not guarantee a positive experience for another patient. That is the reason why doctors urge patients to use the drug only as a prescribed one because only doctors can assess if the benefit justifies the potential risk.

Students use Modafinil with the main goals of getting rid of sleepiness and achieving laser-like focus. However, some students reported that the drug made them focus, but on the wrong things, like playing video games on smartphone.

Very bad headache, appetite loss and excessive need to use the bathroom were reported, too [18].

IV. POSITIVE EFFECTS OF USING MODAFINIL

It has been proved that Modafinil may be useful once-daily treatment for children with ADHD [19]. One study showed that Modafinil reliably enhanced task enjoyment and performance on several cognitive tests of planning and working memory [20]. Improvements under Modafinil were seen on spatial working memory, planning and decision making at the most difficult levels, as well as visual pattern recognition memory following delay. The effects of Modafinil on creativity were inconsistent and did not reach statistical significance.

The research also showed that Modafinil improved decision-making and planning, but also had a positive effect on learning and creativity [22].

For students, it's an almost perfect pill. They could simply take it a few or one night before an exam and have a noticeable advantage over those who do not take any cognitive enhancer. It is important to say that students do not use Modafinil to escape responsibility, in a way that they feel good about doing nothing. They use it to "boost" their memory and to be able to do more quality work. In March 2012, The Royal Society, after one workshop, concluded that the use of "smart drugs" will evolve in the business world, too. They predict that it might influence motivation, enable people to work in more extreme conditions or into old age, reduce work-related illness, or facilitate an earlier return to work after illness [23].

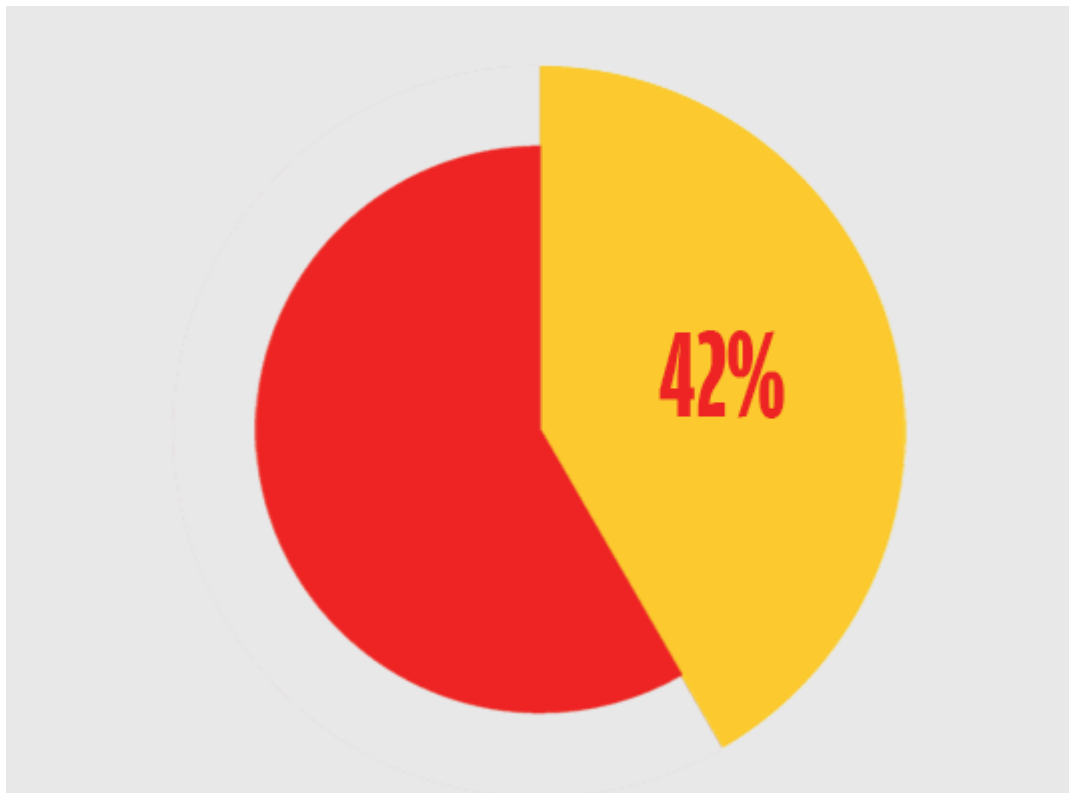


Fig. 3. Percentage of Modafinil Users Who Have Tried Another Study Drug [3]

The effects of Modafinil on the brain are complex and not well understood. One promising theory is that the drug increases blood flow to brain areas serving attention and learning. It might also enhance brain activity in areas thought to act as "conductors", which manage skills like memory, reasoning and problem-solving. [21]

Dr Ruairidh Battleday and Dr Anna-Katharine Brem from the University of Oxford and Harvard Medical School found that the performance-enhancing capacity of Modafinil varied according to the task - the longer and more complex the task tested, the more noticeable cognitive benefits from Modafinil.

In one study, conducted by researchers at Imperial College London, Modafinil was found helpful in helping sleep-deprived surgeons become better in situations that require information processing. It also improved decision making under time pressure [24]. This is of great importance since sleep-deprived doctors may endanger their patients, as well as themselves.

Modafinil is sometimes thought of a capitalism's way to end sleep and enable 24/7 work regime. It could be discussed that Modafinil does exactly the opposite.



Fig. 4. Percentage of Students Who Have Used Modafinil by Subject (United Kingdom) [3]

Performing tasks in less time than usual, people have more spare time to spend with their family, friends, to do the activities after-work they never previously had either time or energy for.

V. CONCLUSION

Modafinil is a very effective cognitive enhancer, despite being clear that it represents an area where many more studies and researches are needed. For the most part, the greatest worry about students taking Modafinil is the source they buy it from. Since in most cases, it's online and without a doctor's prescription, it may contain unknown substances which may endanger students taking it. Modafinil can be used by most people who wish to work late, stay awake or enhance their cognitive skills.

It's of great importance to say that Modafinil is not any sort of a "magic pill" in a way that it does all the work for the user taking it. It simply helps user put more quality work in.

Legal aspects should always be looked into first, since it is different from country to country. In many countries, Modafinil is classified and controlled substance, making it illegal to possess without a valid prescription. Some countries like Russia go as far as putting it in the same category as cocaine and morphine.

Professor Guy Goodwin, the former President of the European College of Neuropsychopharmacology (ECNP) said of Modafinil: "In other words, it's the first real example of a 'smart drug', which can genuinely help, for example, with exam preparation." [25]

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