A-Z GUIDE

ERECTILE DYSFUNCTION

International Andrology
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Introduction

Erectile dysfunction, often referred to as ED, is the inability to achieve and sustain an erection suitable for sexual intercourse. The prevalence of erectile dysfunction increases with age and whilst around **20% of all adult men suffer from erectile dysfunction that rises to 50% for men aged 40 and above**.

It is a subject that many men never discuss openly. It can be unfortunately treated with humour derived from shame and misunderstanding when in reality, there are numerous solutions to treat and reverse the condition successfully.

To provide you with some information on what is happening, what you can do about it and how we can help you, we have written this guide for men, by men, so that you can discuss your situation with those you trust and make an informed decision on what you need to do next.

We hope that if are suffering from ED and you read this guide then you will be compelled to follow the subsequent advice:

- **Do not suffer in silence** - nowadays, all men suffering from ED are treatable – irrespective of the severity or the underlying causes;
- **You should take your ED issues seriously** - as they can be a very important overall health warning;
- **Don't delay treatment** - the longer you wait, the worse the problem will become; and

- **Take control of your general health** - Taking control of and actively improving your lifestyle (diet, exercise, sleep, stress) will go a very long way in improving your erections.

This guide is organised in the following way:

- In the next section we explore the basics of male anatomy and the erection mechanism
- In Sections 2 &3 we analyse the most common causes of ED, their diagnosis and explain why ED is an important health warning that no man should ignore
- In the last section we review the different ED treatments including options to rejuvenate your erections, try to answer the question which is the best ED pill as well as delve into some exciting research regarding future ED treatments.

About Us

International Andrology is the world's leading healthcare group focusing exclusively on men's health. Established in 1990 and with more than 40000 men treated to-date, International Andrology doctors offer the most advanced treatments on issues related to erectile dysfunction, ejaculation disorders, genital health (penis size and shape), hormonal health and subfertility, from three locations worldwide (London, Dubai and Rome).

For more information about ED or to book an appointment visit the **IA dedicated web-page**.

The Basics of Male Anatomy and ED

The Penis

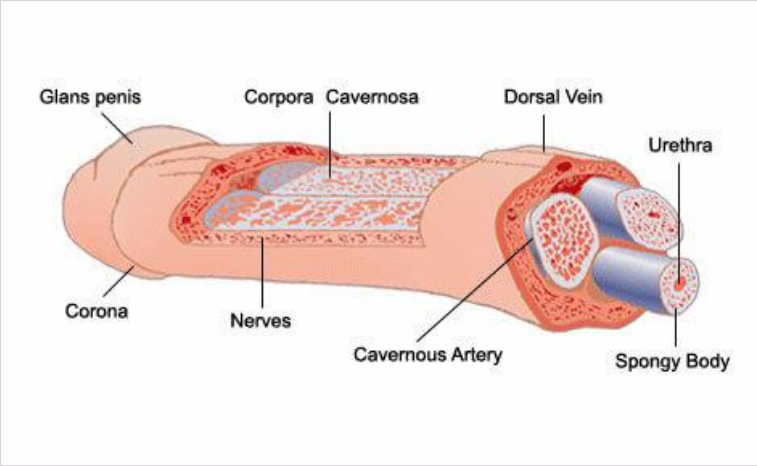
The penis is the male sexual organ.

The shaft is the longest part of it. The head or glans is at the end of the shaft. The opening at the tip of the head, where urine and semen come out, is called the meatus.

Inside, two cylinder-shaped chambers called the corpora cavernosa run the length of the penis. They have a maze of blood vessels, tissue, and open pockets.

The urethra, the tube that urine and semen flow through, runs along the underside of them, in the spongy tissue of the corpus spongiosum.

Two main arteries (one in each of the corpora cavernosa) and several veins move blood in and out. Nerves relay messages to and from other parts of your body.



What Happens When You Get an Erection?

The corpora cavernosa – the erection bodies - are made of spongy tissue and have the ability to gain blood volume and grow in size.

Throughout the day, arteries supplying blood to your penis are only partially open. This provides the blood flow needed to keep your tissue healthy.

In response to sexual (physical or mental) stimulation, your brain sends signals to trigger a hormonal response that allows those same arteries to open completely.

Open arteries allow more blood to enter the corpora cavernosa. The blood enters faster than it can leave through the veins. The veins get compressed, trapping blood in your penis. This chain reaction lets you achieve and maintain an erection.

When your brain stops sending signals that indicate sexual arousal, the hormonal response ends. Your arteries go back to their normal state and your penis returns to a flaccid state.

As such, in order for men to achieve an erection, a number of things need to be functioning correctly:

• The nerves in the penis and those "signalling" the sexual stimulus to the penis must be functioning properly;

• The blood circulation to the penis must be adequate and the internal erection mechanism must be intact;

• The veins must be able to "trap and keep" the blood inside the penis; and

• There must be sexual stimulus from the brain.

Interference with any of these systems may result in sporadic or permanent erection problems.

It is often said that ED can have an organic cause – something is physically wrong - or a psychogenic cause i.e. it is in your head. The reality is that most patients suffering from ED will have a mixed aetiology i.e. an organic cause that is usually exacerbated by performance anxiety and stress. In our experience very few men suffer from pure psychogenic ED. So in this guide, we will mainly focus on the most common organic causes, bearing in mind that irrespective of the underlying reason you initially suffer from ED it is very likely that this will make you stressed (this phenomenon is often called performance anxiety),

which will in turn exacerbate the problem.

How can I tell if I am suffering from "pure" psychogenic ED?

Psychogenic ED by definition means that there is nothing wrong physically with your erection mechanism. As such if you are suffering from "pure" psychogenic ED then you should be able to get good erections under certain circumstances, such as:

- **Strong night or morning erections** – these erections are not a result of a sexual stimulus hence there are a good indication of your overall erection "health". If they are still present or have not deteriorated in quality then your ED might be purely psychogenic.

- During masturbation – many men suffering from "pure" psychogenic ED will be able to still get good erections during masturbation

- **With another partner** – if you are only suffering from ED with a specific partner but other than that you are fine then this might also be indicative of "pure" psychogenic ED

- **When you have ED issues ONLY when you are stressed, have consumed alcohol or taken recreational drugs** – stress, alcohol and drugs can interfere with your erection and if you get ED only under these circumstances then it will not necessarily mean that there is an organic issue.

Common Organic Causes of ED

It is not an exaggeration to say that the quality of erections is one of the best health indicators for men. This does not mean that if you have good natural erections everything is fine but it rather means that if you are suffering from ED then it is very likely that this an important health warning that no man should ignore. This is not surprising since for many men their ED has the same underlying causes with very serious health issues such as Cardiovascular Disease, Metabolic Syndrome and Diabetes. It is a well-established fact that in such cases ED can predate a cardiovascular episode by 3-5 years.

Endothelium & Smooth Muscle Dysfunction

By far the most common cause of erectile dysfunction is endothelium dysfunction, which is also often abbreviated as ED. In brief, so as not to overcomplicate things, the endothelium is a layer of cells that is found throughout the erection mechanism (the corpora cavernosa) and these need to be healthy in order for the erection bodies to expand adequately so as to trap the blood flowing in the penis (the expanding erection bodies trap the blood by effectively becoming engorged and blocking the veins that take away the blood from the penis).

If the endothelium cells (and the accompanying smooth muscle tissue) are not healthy this means that the expanding erection bodies have lost some of their elasticity and although enough blood flows in the penis, the erection bodies do not expand adequately to trap it so as to get an erection.

So what causes Endothelium Dysfunction?

Everything that is bad for your cardiovascular and heart health since endothelium dysfunction is the first stage of cardiovascular disease (the endothelium cells are lining all the arteries in our bodies and cardiovascular disease starts when the endothelium becomes damaged). You might have come across the list of things that are bad for the endothelium, which include:

- Bad diet and obesity (and all the associated health issues such as fatty liver disease, metabolic syndrome and diabetes)
- Lack of exercise
- Low Vitamin D
- Smoking
- Stress
- Lack of or bad quality sleep

In reality, together with aging and smoking, the most important (controllable – since genetics also play an important role) cause of endothelium dysfunction is bad diet and a condition caused (usually) by bad diet called insulin resistance, which in turn can lead to fatty liver disease, metabolic syndrome and type 2 diabetes. This does not mean that the rest are not important and all men with erection issues should check themselves for things

like Vitamin D deficiency (usually caused by insufficient sun exposure) or sleep apnoea. Having said that, from the list above it becomes obvious that your lifestyle will usually be the underlying cause of your erections issues due to the impaired endothelium function. The good news is that drastically improving your lifestyle will not only improve your overall health but can also improve your erections or at least prevent your ED from becoming worse. Even more encouraging is the fact that there are a number of treatments available such as **shockwave therapy and daily intake of PDE-5 inhibitors** that can help heal your damaged erection mechanism.

In terms of diagnosis, endothelium dysfunction in your penis can be checked through a Penis Doppler ultrasound examination (see next Section for more information) as well as some specialised blood tests (ADMA).

Atherosclerosis

A small number of men may have such advanced endothelium issues and damaged arteries that the main arteries to the penis become very narrow (due to plaque formation, a process called atherosclerosis), thus restricting the blood inflow (in addition to endothelium dysfunction) and resulting to severe erection issues. This is also diagnosed through a Penis Doppler Ultrasound. If blood inflow issues due to atherosclerosis are detected, then this will usually mean that the patient has advanced cardiovascular disease and immediate evaluation by a cardiologist is required.

Diabetes & Metabolic Syndrome

Diabetic patients have a much higher prevalence of ED (around 50%) and usually the more severe kind. This is not surprising since the same issues that lead to endothelium dysfunction (bad diet in particular) are also responsible for Type 2 diabetes. Beyond that though, diabetes itself can independently harm the erection mechanism by exacerbating the endothelium damage as well as damaging the nerves involved in the erection. The unfortunate thing is that many men (and women) have undiagnosed diabetes or pre-diabetes (often called Metabolic Syndrome) so it is very important that if you have ED to also check your blood sugar, insulin and lipids levels, if these were not recently checked.

Low Testosterone and Other Hormonal Issues

Testosterone is the male hormone and is produced by the testicles. It is an essential hormone that affects all our organs but the erection mechanism is particularly vulnerable to low testosterone levels. In fact, the most telling sign that your testosterone levels might be low is reduced libido and ED. Testosterone levels drop as we age but they can also be low because of a number of issues including problems with the testicles, problems in the brain (which signals testosterone production) or (again!) due to obesity/bad diet. Another

hormone that is important for the erection mechanism is prolactin, which would also need to be checked since it might be the result of a benign brain tumour called prolactinoma.

Radical Prostatectomy and Pelvic Trauma

Men who have had a radical prostatectomy (removal of the prostate gland) surgery because of prostate cancer will almost certainly face ED issues, which in many cases will be severe. This happens because the nerves and the arteries involved in the erection mechanism get severely damaged when the prostate is removed. This in turn means that for some time following the surgery there will be complete absence of erections, which might also result in fibrosis in the erection mechanism due to inadequate highly oxygenated blood flowing in the corpora cavernosa. So following radical prostatectomy, it is very important to immediately address the lack of erections in order to prevent further damage. In addition to radical prostatectomy any trauma or surgery in the pelvic area may also damage the local nerves and arteries and result to ED.

Peyronie's Disease and other Anatomical Issues

Peyronie's is a disease that affects the erection bodies of the penis. Although we do not know the exact causes of Peyronie's, it affects 3-9% of adult men and it results to a fibrotic (scar tissue) plaque forming on the corpora cavernosa (usually there is only

one localised plaque but there can also be multiple). Although the plaque itself is benign, it anatomically affects the penis. Common sign of Peyronie's disease is pain and mild or severe penile curvature during erections, a palpable lump on the penis shaft and unfortunately erectile dysfunction. When it comes to ED, it is unclear whether the plaque leads to ED or whether ED and Peyronie's have common risk factors. Irrespective, it is important to rule out Peyronie's disease (through a penile ultrasound examination) or any signs of corporal fibrosis when first diagnosed with ED.

Beyond Peyronie's, there are various anatomical issues of the penis that might affect erections including a tight frenulum or foreskin and congenital (i.e. from birth) penile curvature. These can all be evaluated during a physical examination by your doctor through an artificial erection test (see next section for more details) and review of your medical and sexual history.

Drug Interactions

Drugs used to treat male baldness, statins, anti-depressives, high blood pressure and others can affect your erections for a number of reasons. If your doctor suspects that any medication that you are currently taking, contribute to your ED issues, then he might recommend stopping them or switching to alternatives.

Venous Leak

In very rare cases, there might be an abnormal vein in your penis that does not get blocked by the expanding erection mechanism. As a result, although there is enough blood inflow and the erection mechanism works well, this leaky vein drains the blood thus preventing the formation of an erection. Most men who suffer from venous leak, usually do so from a very young age and are unresponsive to ED medication. Another sign of venous leak might be that your ability to maintain an erection might depend on the position during sexual intercourse. If your doctor suspects venous leak, then he might request a more specialised test called CT Cavernosography so as to confirm the presence of the leaky vein(s). Initial treatment involves either cutting or embolizing (clogging) the leaky vein. If that is unsuccessful then a penile implant surgery would need to be considered.

Diagnostic Evaluation of ED

An experienced doctor will be able to gauge how severe are your erection issues and the potential contributing causes by obtaining a good medical (including an in-depth lifestyle evaluation) and sexual history. Having said that, there are various tools and diagnostic tests that your doctor might request or perform in order to assist him with his evaluation. The most common are the following:

IEEF-5 Questionnaire

The first tool is a short questionnaire called the IEEF-5. This multiple choice questionnaire has been very widely used and researched for over 20 years. The answer to each question is scored (0 – 5) and a total score (out of 25) is calculated. Low scores are correlated with severe ED and vice versa. A low IEEF-5 score does not necessarily imply that treating your ED will be more difficult or that there is a very severe underlying organic cause, it just gives an initial indication. A more meaningful use of the IEEF-5 questionnaire is to use it to track how successful is your treatment plan by monitoring your IEEF-5 score before and after treatment.

Over the past 6 months:					
1. How do you rate your **confidence** that you could get and keep an erection?	Very low 1	Low 2	Moderate 3	High 4	Very high 5
2. When you had erections with sexual stimulation, **how often** were your erections hard enough for penetration?	Almost never/never 1	A few times (much less than half the time) 2	Sometimes (about half the time) 3	Most times (much more than half the time) 4	Almost always/always 5
3. During sexual intercourse, **how often** were you able to maintain your erection after you had penetrated (entered) your partner?	Almost never/never 1	A few times (much less than half the time) 2	Sometimes (about half the time) 3	Most times (much more than half the time)4	Almost always/always 5
4. During sexual intercourse, **how difficult** was it to maintain your erection to completion of intercourse?	Extremely difficult 1	Very difficult 2	Difficult 3	Slightly difficult 4	Not difficult 5

5. When you attempted sexual intercourse, **how often** was it satisfactory for you?	Almost never/never 1	A few times (much less than half the time) 2	Sometimes (about half the time) 3	Most times (much more than half the time) 4	Almost always/always 5

IIEF-5 scoring:

The IIEF-5 score is the sum of the ordinal responses to the 5 items.

22-25: No erectile dysfunction

17-21: Mild erectile dysfunction

12-16: Mild to moderate erectile dysfunction

8-11: Moderate erectile dysfunction

5-7: Severe erectile dysfunction

Artificial Erection Test

The Artificial Erection Test (AET) involves your doctor injecting a powerful erection inducing medication (most common compound is Alprostadil) in one of the corpora cavernosa of your penis. Although this may sound painful, the reality is that you will hardly feel anything. After the injection, the doctor will evaluate your erection hardness score using the following scale:

0 – Penis does not enlarge.

1 – Penis is larger, but not hard.

2 – Penis is hard, but not hard enough for penetration.

3 – Penis is hard enough for penetration, but not completely hard.

4 – Penis is completely hard and fully rigid.

If you have a low score then the doctor might gradually increase the dose of the medication until you get a 3 or 4 score. Based on your response and the maximum dose administer, the doctor will be able to assess the severity of your ED. The AET is a very useful tool to identify patients whose erections are very severely damaged and who do not get any response from the injection. In such rare cases (less than 10% of men suffering from ED) the only viable treatment option is usually a penile implant surgery (see the dedicated section for more details). In addition, the doctor is able to examine the penis in the erect state and note any abnormalities such as plaques or curvature seen in Peyronie's disease.

Blood & Hormonal Testing

Typical blood tests that your doctor might request are the following:

- Testosterone and other hormones such as LH, FSH (affecting your testosterone levels) and prolactin

- Lipids, fasting blood glucose, insulin and HbA1C (an average longer term measurement of blood glucose levels) so as to evaluate your cardiovascular and metabolic health

- Vitamin D

- ADMA, SDMA, Homocysteine to evaluate endothelium function

More specialised tests might be requested by your doctor if other underlying pathologies are suspected.

Sleep monitoring

This test involves monitoring erections during sleep. It has been long established that healthy men will experience a number of erections (3-5) during a good night's sleep. This test may be useful in a young patient where the diagnosis of psychogenic ED is suspected. If erections occur and are documented, the patient's ED is most likely psychogenic. Another use of this test is to check whether your treatment or lifestyle adjustments are helping to restore/improve your night erections, which would indicate that your erection mechanism is healing and your natural erections are improving, as opposed to deteriorating which is what happens for most patients who just take ED meds and leave the underlying causes untreated.

Ultrasound Examination

A duplex ultrasound is a test to examine the blood flow through the arteries and veins in the penis. It combines traditional ultrasound with doppler ultrasound. Traditional ultrasound uses sound waves that bounce off blood vessels to create images. Doppler ultrasound records sound waves reflecting off moving objects (example: blood cells), to measure their speed and other aspects of how they flow.

This procedure involves the injection of erection inducing medication into the penis. The drugs cause a dilation of the blood vessels supplying the penis, thus causing an erection. Men with diseased blood vessels which may be caused by high blood pressure, arteriosclerosis, diabetes, etc., will not develop a full erection. Therefore, the test will tell us whether the erectile dysfunction is due to arterial vascular disease.

Moreover, the ultrasound allows the doctors to visualize the cavernosal arteries and muscle tissue, allowing for the detection of abnormalities such as fibrosis and calcifications of the erectile muscle.

Lastly, the ultrasound examination can detect the presence of a veno-occlusive dysfunction, which would prevent trapping and storing of blood in the penis sufficient to maintain an erection. Measuring the ratio of blood flow into the penis while the heart is pumping versus when it is at rest can assess this. This measurement is called the resistive index, and is based on the observation that in a normal erect penis, the pressure inside the erectile chamber of the penis exceeds the pressure in the arteries when the heart is at rest, and therefore no blood should be flowing into the penis. If blood flow occurs in this situation, the diagnosis of veno-occlusive dysfunction is confirmed.

What are my treatment options?

With the proliferation of oral medications such as Viagra and other similar drugs (PDE-5 inhibitors), the public awareness and treatment options for erectile dysfunction have increased significantly. Although ED pills have proved very successful in helping millions of men overcome their erections issues, the reality is that taking a pill before sex only treats the symptom but not the underlying cause of the disease. As such, many men with ED remain under-treated since the health issues causing their ED are not identified or addressed.

At International Andrology our aim is to provide a personalised treatment plan to all our patients that will not only **enhance their erections during sex** but most importantly **heal their damaged erection mechanism and prevent further deterioration**, **address the underlying causes of their ED** and **help them adopt a healthy lifestyle that will improve** both their erections and their overall health and quality of life!

Healing (or rejuvenating) the damaged erection mechanism

As discussed in the previous section, for the majority of patients with organic ED, the main reason for their issues is the fact that their erection mechanism is compromised because of endothelium/smooth muscle dysfunction. It is also likely that there is some fibrosis (scarring) in the corpora cavernosa because of a reduction in their night erections. Unfortunately, ED

medications before sex might help temporarily achieve better erections but do not really heal the diseased erection mechanism.

Fortunately, there are various treatments modalities that have the potential to rejuvenate the erection mechanism, including:

- Extra-corporeal Shock-wave Therapy

- Platelet Rich Plasma (PRP) Injections

- Stem Cell Injections

All of these options seem to be quite well tolerated and safe to administer but in terms of efficacy, only shockwave therapy has enough scientific evidence to suggest that it can lead to actual erection rejuvenation. This does not mean that PRP or stem cell injections do not work but that the necessary research to evaluate their therapeutic effects has not been carried out yet.

At International Andrology, we believe that erection rejuvenation and shockwave therapy (and the other rejuvenation options when their efficacy is proven) has a pivotal role to play in the ED treatment for most of our patients and we have seen great results to-date. For more information on this treatment option, please read the Frequently Asked Questions below.

Shock Wave Therapy Frequently Asked Questions

How does it work?

Extracorporeal Shock Wave Therapy (EWST) works by passing shock waves, an intense but short energy wave that travels faster than the speed of sound into the tissues. Originally it was used to treat kidney stones in the 1970's by using acoustic shockwaves to break up the stones without the need of surgery. Clinicians soon discovered that whilst patients were being treated for kidney stones they reported that other non-related medical conditions either improved or had disappeared entirely. This in turn lead to the discovery that shockwaves had a healing impact on pain and chronic conditions in the musculoskeletal system. Devices were then developed to treat a range of tissue injuries on all different parts of the body. Today Shockwave therapy is widely used to treat all kinds of indications from soft tissue injuries (tendinopathies) in humans and horses to diabetic foot ulcers to **erectile dysfunction** and even cellulite.

Shockwave treatment initiates a pro-inflamatory response in the tissue where the shockwaves have been applied. The body responds by increasing the blood circulation and metabolism in the impact area which in turn accelerates the body's own healing processes.

In the specific case of Erectile Dysfunction, shockwave improves erections via two mechanisms:

1. **Promotes angio-genesis** (development of new blood vessels) in the penis which means that the blood flow to the penis increases and hence stronger erections are achieved; and
2. **Rejuvenation of the endothelium and penis smooth muscle** – Shockwave therapy has been shown to induce the body to

repair the endothelium and smooth muscle in the penis and thus improve the function of the veno-occlusive mechanism.

Am I candidate for Shockwave Therapy?

Theoretically, shockwave therapy can help all patients suffering from ED and even improve erections in men with no issues or in order to prevent erectile dysfunction.

Patients that do not respond to an artificial erection test, are NOT good candidates for shockwave therapy, since this will generally mean that their erection mechanism is significantly damaged and it is unlikely that they will benefit from this treatment modality.

What are the expected benefits?

There is a growing body of scientific evidence that suggests that shockwave therapy for ED can help in the following ways:

- Patients with mild to moderate ED that respond well to PDE-5 inhibitors, might be able to regain their natural erections and no longer need - or reduce their dependence on medication.
- Patients with moderate to severe ED that do not respond to PDE-5 medication and rely on injections or other topical treatments, may become respondent to PDE-5 medication after shockwave therapy.
- Shockwave therapy will in most cases improve the outcome of any other treatment.

- Shockwave therapy can delay the deterioration of the ED issues.

What should I expect during my treatment session?

Each treatment session lasts around 20 minutes. When you arrive at the clinic a nurse will take you to the room with the shockwave machine where you will lie on the treatment bed. The medical practitioner will then apply the treatment using a special probe on different parts of your penis and perineum. Most patients experience very little discomfort or pain during the session. It is important that if you do not feel comfortable you let your medical practitioner know and the shockwave intensity will be adjusted accordingly.

What is the best Shockwave Therapy treatment protocol?

This is an area of very active research. A number of treatment protocols have been suggested, some lasting only 4 sessions and some as long as 12 sessions and the clinical trials investigating these protocols are quite different in a number of ways (energy of the shockwaves applied, number of shockwaves, number of sessions, duration of treatment and time between sessions and the technology of the shockwave machines).

Whereas all these trials have proven the treatment benefits, there is no clear protocol that applies to all patients. Our own experience and the studies so far indicate that the there is no one size fits all protocol and the number of sessions will depend on the severity of ED, the presence of comorbidities and the

response to the treatment. At our clinic, as a minimum, we recommend 6 twenty-minute sessions over a three-week period.

Regarding the number of pulses, the range should be between 3000 and 5000 shock waves per session and there is evidence to suggest that administering more shock waves leads to greater improvements. It also seems beneficial to deliver treatment to multiple sites to reach the vascular bed of the erection mechanism.

At our clinic, your treatment physician will be constantly monitoring your progress, adjusting the protocol according to the response of your body and taking into account all the different parameters that are explained here.

Can I repeat the treatment on a regular basis?

As the method seems to have a physiologic effect on the erection mechanism, repeating the treatment after a certain period of time seems logical; however, the question regarding a possible saturation effect remains unanswered and requires further investigation.

Are the results permanent?

The biological effects of shockwave therapy are permanent and have been established on the basic science level. However, erectile dysfunction depends on the lifestyle of patients and is usually a symptom of underlying health issues which lead to ED. Because ED usually gets worse in patients with comorbidities or negative lifestyle factors, this means that the improvements after

the treatment might be reversed over time if the underlying conditions are not addressed.

Is the Shockwave Therapy treatment itself painful?

At times the treatment might be a bit painful, but most people can stand these few intense minutes without medication. If patients are in pain during the treatment, they should notify the medical practitioner as there are some adjustments that can be made to reduce the discomfort, however, having some pain during the treatment indicates that shockwaves are having a positive effect.

Will there be pain after the treatment?

Normally patients experience a reduced level of pain or no pain at all immediately after the treatment, but a mild and diffused pain may occur a few hours later. This dull pain can last for a day or so.

What if there is pain after the treatment?

Shockwave therapy treatment initiates a pro-flammatory response in the tissue that is being treated. If necessary patients may use ordinary prescription-free pain killers. Do not use anti inflammatory medication or ice on the treated area as both may interfere with the body's self-healing process.

What if the shockwave therapy treatment doesn't work?

Usually the response to shockwave therapy treatment is good, however it may take several months before maximum effect is achieved. If after 3-4 months the patient still does not experience

a pronounced improvement, then booster sessions or other treatment modalities will need to be considered.

ED Pills

The first ED pill, Viagra, was introduced in 1998 and it is not an exaggeration to say that ED pills are one of the most successful – commercially and in terms of results - drugs, ever!

Because of ED pills, hundreds of millions of men have been able to regain their erections and salvage their sex lives.

How do ED pills work?

As explained previously, erections are caused by increased penile blood flow resulting from the relaxation of penile arteries and the smooth muscle cells.

This process involves a few steps; following sexual stimulation the local nerves and the endothelial cells in the penis release nitric oxide, which in turn increases the production of a chemical called cGMP (cyclic guanosine monophosphate), which relaxes the smooth muscles and increases blood flow. Another chemical, found in the erection mechanism, called phosphodiesterase type 5 (PDE5) breaks down cGMP and reduces its concentration. ED pills, effectively block PDE5 (that is why they are called PDE5 inhibitors), thus allowing more cGMP to form and act on the erection mechanism smooth muscle, which in turn improves erections.

This means that ED pills only enhance erections, rather that induce erections (like penile injections do), **when a man is sexually stimulated**. After orgasm or when there is no sexual stimulation, the penis returns to the normal flaccid state even if you have taken a pill.

Is it safe to take ED pills?

This is a question that lingers in the mind of many men and it is not uncommon for our patients to think that taking an ED pill might give them a heart attack or some other scary side effect, like impaired vision.

The reality is that for the vast majority of men, ED pills are not only very safe to take, but there is research to suggest that they can also have significant health benefits beyond better erections, including improved cardiovascular health, prostate function and even cancer prevention!

Having said that, there are some categories of drugs, such as nitrates and alpha blockers, that interact with ED pills and can lead to hypotension (low blood pressure) which can be dangerous. As such, you should always consult a doctor before taking an ED pill, especially if you are on any other medication. Beyond that, since the aim of taking ED meds is to have sex, if you recently had any serious health issues, have been advised to avoid strenuous activities or you are in general very unfit then

consult your doctor if it is safe, from a cardiovascular perspective, to have sex.

Another concern about ED pills are temporary side effects such as muscle aches, back pain, head-aches, blocked nose, bowel irritation and vision problems. These issues are usually dosage dependent and occur in less than 10% of men. For many men these issues are quite tolerable and transient. However, if you are concerned about or experience such issues then inform your doctor and he might recommend a different dosage or pill.

Which is the best ED pill?

There are currently 4 commercially available ED pills that all work in the same way (they all belong to the class of drugs called PDE-5 inhibitors) but exhibit some significant differences. The four categories and their main characteristics are the following:

Drug Name	Popular Brands	Efficacy & Dosage	Duration of effect	Cost	Interaction with food and alcohol intake	Side-effects
Tadalafil	Cialis	All ED pills are equally effective (no	36h	Low (generic available)	None	Very Low

Sildenafil	Viagra	significant differences found in comparative studies) and their strength depends on the dosage. All pills come at different dosages.	4-6h	Low (generic available)	Food and alcohol intake can affect action	Low
Vardenafil	Levitra		4-6h	High (still patent protected)	Food and alcohol intake can affect action	Low
Avanafil	Spedra		4-6h	High (still patent protected)	Food and alcohol intake can affect action	Low

Most men have heard of Viagra simply because it was the first pill to become available. To help you understand which ED pill might work best for you, we will look at each characteristic in turn.

Efficacy & Dosage

Winners: Sildenafil (Viagra) & Tadalafil (Cialis)

All ED pills exhibit similar effectiveness in terms of improving erections and the majority of men (70%) with benefit from taking them. There are no significant differences in their efficacy but on an individual level one type of pill can potentially work a little better than others. In terms of efficacy, meaning how strong erections you will achieve, the most important parameter is the dosage. All pills come at low, standard and high doses. Most men

start at the standard dose and will switch to higher if their response is not good or to the lower one if they experience any side effects.

In a recent study that compared standard dosage efficacy of the different ED pills, sildenafil (slightly higher efficacy) and tadalafil came on top followed by vardenafill and avanafil in the last place.

Why do ED pills stop working? And how to prevent your ED from getting worse.

Most men suffering from ED will initially try oral medication like Viagra, which will be enough to regain good erections. However, as time passes by, higher and higher doses of these medication will be required (e.g. starting with 50mg and switching to 100mg) in order to achieve the same effect. After a while, the pills might stop working and many men will need to use erection inducing injections before sex. Eventually, even the injections might stop working and the only treatment option left will be the surgical replacement of the damaged erection mechanism with a hydraulic device called the penile implant.

But why is this happening?

- **Treating the symptom and not the cause**

A lot of men think that there is a saturation effect of ED medication i.e. our bodies are getting used to the drugs and they stop working. However, there is extensive scientific evidence that this not true. On the other hand, since on-demand (i.e. before sex) erection medication do not treat the underlying causes of ED, it is only normal that, as these causes continue to affect you, things will progressively become worse UNLESS you do something about the existing damage and also address (as far as this is possible) the underlying causes of ED.

- **Use it (during sleep) or lose it**

As mentioned in the previous section, healthy men experience 3-5 erection episodes during sleep. It is hypothesised that this is the way the body provides highly oxygenated blood to your erection tissues so as to keep them healthy. If you are suffering from ED then one of the first things affected are your night and early morning erections, which will in turn mean further deterioration of your erectile function. So restoring your night erections is very important.

Duration of Effect

The winner: Tadalafil (Cialis)

An important clarification before we delve into the details. By duration of effect we do not mean how long an erection lasts if you take an ED pill. In general erections only last (with or without ED pills) as long as you are sexually stimulated or until you orgasm. As explained, ED pills help you **get stronger erection while sexually stimulated**, they do not prolong erections or ejaculation time. With that in mind, the duration of effect of an ED pill refers to the time that the medication is active in your body. So for example if you take a pill of Viagra which has a duration of effect of 4-6 hours and you have sex within that time window then Viagra will improve your erections, however if you try to have sex 12h later then the pill's effect on your erections will have worn out and you would need to take another pill.

In that respect, the ED pill with the longest duration of effect is Tadalafil, which lasts 36h whereas all the others have a duration of effect between 4-6h. For this reason, most patients prefer Tadalafil after they try it (and we usually recommend it) since it allows a bigger window of opportunity to have sex and do so multiple times without needing to take another pill, which can be inconvenient and costly.

Another very important aspect of the long duration of effect of tadalafil is that many men will prefer and/or be recommended to take a daily ED pill as opposed to on demand (i.e. before sex) so that they are constantly exposed to the beneficial effects of the medication (this is very important as will be explained later). In

order to achieve this with tadalafil, you only need to take 1 pill per day as opposed to 4-6 pills daily with the other medication.

Cost

The winners: Tadalafil (Cialis) & Sildenafil (Viagra)

Tadalafil and Sildenafil are off patent protection meaning that any drug manufacturing company can manufacture generic versions of the medication. Generic medications are exactly the same as the original branded ones but are much cheaper. As a result, generic Tadalafil (off patent since 2017) and Sildenafil (off patent since 2013) have very low prices whereas Vardenafil (Levitra) and Avanafil (Spedra) are still under patent protection and are significantly more expensive. As an illustrative example, branded Viagra costs around £40 for 4 pills, whereas generic Viagra costs around £8 for 4 pills although the medication is exactly the same, the manufacturing company is the same (Pfizer) and only the name and the packaging is different.

For this reason, we always advise patients to ask their pharmacists for the generic ED pills or buy from reputable online pharmacies, which usually have even lower prices.

Interaction with food and alcohol

The winner: Tadalafil (Cialis)

It is generally recommended that Sildenafil (Viagra), Vardenafil (Levitra) and Avanafil (Spedra) are taken with an empty stomach since fatty foods and alcohol can affect their efficacy.

Tadalafil (Cialis) on the other hand is not affected by any food or alcohol intake. This seems to be another reason why patients overwhelmingly prefer Tadalafil compared to the other ED pills since it requires less planning or imposes less restrictions when taking the medication.

Side-effects

The winner: Tadalafil

Some men (around 10%) who take ED pills will experience side-effects including headache, flushing, muscle aches, dyspepsia and nasal congestion. Similar to efficacy, the occurrence and severity of side-effects is mainly dose depended. In a recent meta-analysis study comparing standard dosage side-effects of the different pills, Tadalafil had the lowest overall rate of all adverse events whereas vardenafil, avanafil and sildenafil had similar overall adverse events.

Summary

Based on our analysis of the different ED pills characteristics, it becomes obvious why the vast majority of patients who first try ED medication prefer Tadalafil, which is the drug that also displays the highest treatment adherence.

Beyond that, another very important advantage is that tadalafil (the 2.5mg or 5mg dose) can be also taken daily. As explained

below, taking a pill daily as opposed on demand has some very significant advantages.

ED pills daily vs on-demand

Throughout this guide we have mentioned a few times that ED pills do not treat the underlying causes of ED and hence will not improve your natural erections. Well, we have kind of lied!

Although ED pills before sex will not arrest the deterioration of your erection issues, the reality is that there is scientific evidence to suggest that taking an ED pill daily as opposed to on demand (i.e. before sex) will not only slow down the progress of ED but in some cases even resolve your erections issues altogether.

But Why?

The answer, is that taking an ED pill daily, which works around the clock, will also improve your night erections, which as mentioned earlier, is your body's way to preserve the health of your erection mechanism. Research suggests that better night erections, will mean slower progress or even reversal of ED.

Another benefit is that if you take an ED pill daily, your body will become accustomed to any potential side-effects and these will stop being bothersome.

In terms of cost, generic daily tadalafil (2.5mg or 5mg dose) supply of one month will usually cost the same as 8 generic on demand ED pills (tadalafil or sildenafil).

For this reason, we usually recommend to our patients the daily tadalafil regimen.

Penile Injections and other on demand treatment options

The first successful pharmacological treatment of erectile dysfunction was through penile injections of papaverine and phenoxybenzamine. To date, a number of medications have been used for this purpose, most commonly papaverine, phentolamine and alprostadil in isolation or as a mix.

Penile injections are administered by the patient himself just before sexual intercourse and they induce an erection within 5 minutes. The use of an injection mechanism similar to that for insulin injections makes administration easy and painless.

In most cases, penile injections will be recommended to patients as an erection enhancer when ED pills do not work (around 30% of men suffering from ED) or as a booster for patients taking daily tadalafil and suffer from severe erectile dysfunction.

Penile injections do not require any sexual stimulation to work (this means that erections will be achieved irrespective of sexual desire) and their efficacy rate is significantly higher than PDE-5 inhibitors. On the other hand, taking an oral pill as opposed to administering an injection before intercourse is more acceptable for most patients.

The type and dosage of injection therapy that will result in maximum responses is patient specific and will thus need to be evaluated during a consultation with your doctor.

Beyond ED pills and penile injections, other topical treatments that can help induce erections are MUSE pellets (inserted in the urethra) and a topical cream called Vitaros. Unfortunately, although these treatment options sound appealing and might play a role for men who do not respond to ED pills and do not want to inject themselves, the reality is that they are rarely used and treatment satisfaction is significantly lower than ED pills or injection therapy. Having said that, for some men who might have issues with the engorgement of the penis glans (the head of the penis) during erections, applying the Vitaros cream or inserting a MUSE pellet at the head of the penis might be helpful.

Lifestyle Counselling and Erectile Dysfunction

We hope that by now, the reader of this guide will have been convinced that a man's lifestyle is at the heart of his erection issues. Unfortunately, many doctors and clinics focus only on treating the symptom (weak erections) rather than also addressing the root cause, which is usually a medical problem (endothelium dysfunction or low testosterone for example) exacerbated by poor lifestyle. In this context, by lifestyle we mainly mean:

- Diet;
- Exercise;
- Sleep;

- Smoking, Excess Alcohol, Recreational Drugs; and
- Stress.

Addressing these lifestyle factors will not only improve your overall health and appearance but **our belief is that your erection issues can be reverse or at least halt the progress of ED, your testosterone levels can go up and your overall sexual function significantly ameliorated.**

This point cannot be stressed enough and we believe that lifestyle counselling should be at the core of any andrology practice. If you are suffering from ED then the best thing you can do for yourself is to evaluate whether your lifestyle contributes to your erections issues (for the vast majority of men it does) and do something about it. It can literally save your life!

Psycho-sexual counselling

Beyond lifestyle, psycho-sexual counselling has also an important role to play in the treatment of ED.

Erectile dysfunction in most men is multi-factorial and the result of ongoing interacting relations among biological, cognitive, emotional and behavioural, contextual, and interpersonal contributing factors.

Consequently, psycho-sexual counselling can work in conjunction with other treatment options in order to improve a patient's sexual function. During your consultation, your doctor will evaluate you medical and personal history and may refer

you for further psycho-sexual counselling and support if this is deemed necessary.

Low Testosterone Treatment

Low Testosterone (Low T) or hypogonadism (as it is medically referred) can be a contributing factor to your erection issues.

Low T can have a significant effect on your health (beyond your erections, in men, low T is linked notably to inflammation, weight gain, and cardiovascular issues) but it also may be an indicator of other underlying health issues.

Thus is your doctor suspects that you are suffering from hypogonadism then this would need to be addressed.

How is Low T diagnosed?

Total T is all the testosterone you've got floating around in your blood. It has three components:

• Tightly bound testosterone. About two-thirds of the testosterone in your blood is bound to sex-hormone-binding globulin (SHBG). Your body can't use it.

• Loosely bound testosterone. About a third of the testosterone in your blood is bound to albumin. Your body can use it, with some effort.

• Free testosterone. A small percentage of the testosterone in your blood (1–4%, as a rule) just floats around freely. Your body can readily use it.

Together, your loosely bound T and free T compose your bioavailable T, which has a greater impact on your health than your total T. For that reason, SHBG is often tested at the same time as total T (the higher your SHBG, the lower your bioavailable T).

The problem with diagnosing low testostorone is that the normal levels may greatly differ from man to man and even worse different medical labs might also have different levels that they consider normal!

Beyond some very clear pathologies that cause clearly low testosterone levels (associated with testicular failure or issues with your hormonal glands in your brain) it has been observed that as men age there is decline in their testosterone levels. Men start experiencing a yearly drop in total T (1–2%) and bioavailable T (2–3%) in their 30s. But is this drop caused entirely by the aging process itself? Or could it also be due to men exercising a lot less and eating a lot worse as they near middle age?

Same as with muscle mass, nobody really knows what a "natural" decline in testosterone looks like in the human species. So in order to diagnose low T a simple blood test of your T levels is not adequate and your doctor would need to triangulate the diagnosis.

Testosterone Replacement Therapy

Assuming that your doctor makes a diagnosis of low T then beyond treating the underlying health issues (if these are apparent) and lifestyle counselling, you might also be

recommended to commence Testosterone Replacement Therapy, which is a fancy way to say that you need to top up your testosterone levels through medication.

Several testosterone delivery methods exist:

- **Injection**. Testosterone injections are safe and effective. Injections are given in a muscle. Your symptoms might fluctuate between doses depending on the frequency of injections.

- **Patch**. A patch containing testosterone is applied each night to your back, abdomen, upper arm or thigh. The site of the application is rotated to maintain seven-day intervals between applications to the same site, to lessen skin reactions.

- **Gel**. There are several gel preparations available with different ways of applying them. Gel application of testosterone replacement therapy appears to cause fewer skin reactions than patches do. A potential side effect of the gel is the possibility of transferring the medication to another person and as such patients should avoid skin-to-skin contact until the gel is completely dry or cover the area after an application.

- **Gum and cheek (buccal cavity**). A small putty-like substance, gum and cheek testosterone replacement delivers testosterone through the natural depression above your top teeth where your gum meets your upper lip (buccal cavity). This product quickly sticks to your gumline and allows the medication to be absorbed into your bloodstream.

- **Implantable pellets**. Testosterone-containing pellets (Testopel) are surgically implanted under the skin and need to be replaced every three to six months

Choosing a specific therapy will depends on your preference for a particular delivery system, the side effects and the cost as well as your doctors advise.

Surgical Treatment for Erectile Dysfunction

Even though conservative treatments for ED have recently become very advanced, there are still some patients who do not respond to pharmacological therapy and a surgical treatment is the only option (around 5% of patients).

Overall there are two broad categories of surgeries for erectile dysfunction. The first is vascular surgery, which aims to increase

blood inflow to or reduce blood outflow from the penis. The second, is the penile prosthesis surgery, which offers a final and permanent solution to erectile dysfunction irrespective of the underlying causes.

Vascular Surgery

This type of surgery is only appropriate for a few select cases of patients with very specific symptoms.

Venoligation or Sclerotherapy

This type of operation aims to decrease the blood outflow from the penis during erections and it is only appropriate for young men with primary (i.e. lifelong) erectile dysfunction that exhibirt abnormal ultrasound parameters suggestive, of specific venous leak (increased End Diastolic Velocity). In such cases and before considering an implant, it might be appropriate to ligate or embolise the deep dorsal vein or a particular abnormal vein, established through cavernosography.

Penile Revascularisation

This type of operation aims to increase the blood inflow to the penis by increasing the level of vascularization. Appropriate candidates for this operation are patient suffering from lifelong ED and abnormal ultrasound parameters (decreased Peak Systolic Velocity) and localised stenosis, which has been established through an arteriography.

Penile Prosthesis Surgery

Penile prosthesis surgery involves replacing the damaged natural erection mechanism (corpora cavernosa), with a mechanical device, the penile prosthesis, that in effect allows the patient to induce erections on demand.

How Does the Penile Prosthesis Work?

The inflatable penile prosthesis consists of two attached cylinders – a reservoir and a pump – which are placed surgically in the body. The two cylinders are inserted in the penis and connected by tubing to a separate reservoir of fluid. The reservoir is implanted under the groin muscles. A pump is also connected to the system and sits under the loose skin of the scrotal sac, between the testicles.

This penile prosthesis is referred to as a 3-piece inflatable penile prosthesis, due to the three different components. A 2-piece inflatable penile prosthesis consists of only two components: the attached cylinders and the combined reservoir and pump unit. Instead of the reservoir being placed behind the groin, it is combined with the pump into one housing unit that fits comfortably within the scrotum. The advantage of a 2-piece prosthesis in that the surgery is shorter and less complicated and there is no device parts in the abdomen. The disadvantage of the 2-piece prosthesis is that the smaller reservoir may not result in adequate erections in some men.

To inflate the prosthesis, the man presses on the pump. The pump transfers fluid from the reservoir to the cylinders in the penis, inflating them and causing an erection. Pressing on a deflation valve at the base of the pump returns the fluid to the reservoir, deflating the penis and returning it to the normal flaccid state.

How Does the Penile Prosthesis Look and Feel?

The look, feel and function of the penis (both in flaccid and erect states including ejaculation and orgasm) is exactly the same after the prosthesis surgery with the exception that the patient can achieve an erection whenever he desires irrespective of sexual stimulation and without using any PDE-5's or penile injections. More importantly, prosthesis implantation has the highest satisfaction rates (92-100% in patients and 91-95% in partners) among the treatment options for erectile dysfunction. Nonetheless, penile prosthesis will be usually considered in severe erectile dysfunction cases when patient response to PDE-5s and penile injections is unsatisfactory. In summary the advantages of penile prosthesis surgery are the following:

Advantages of penile prosthesis surgery

- Offers a final and permanent solution to erectile dysfunction irrespective of the underlying causes
- Exhibits the highest satisfaction rate among erectile dysfunction treatments
- Relatively simple day-care surgery with minimum discomfort and interruption for the patient if performed by experienced doctors
- Achievement of on demand erection

Naturally, as is the case with all medical operations there is a small possibility of complications. The two most severe complications is mechanical failure (less than 5%) and infection of the prosthesis (2-3%). In both cases, the complications can be resolved with a revision of the surgery and/or replacement of the prosthesis. Revision surgery has a success rate of 93%, bringing the total success rate of penile prosthesis surgery to over 99%, which is extremely high.

Future Erectile Dysfunction Treatments

There are a number of new medications and treatments that are being investigated or it is hypothesized that they can treat ED. Although we do not offer these treatments given that they are still at a very experimental level, we are nonetheless following closely the developments and doctors within our network are involved or in fact lead a number of trials. When appropriate we will discuss these treatments with patients that might be interested.

Botox

A clinical trial carried out by our doctors in collaboration with Cairo University Andrology department, has confirmed that Botox might be a revolutionary new treatment for erectile dysfunction.

Nearly 50% of men who received a 50ml injection of Botox, (botulinum toxin type A, the active component of Botox) as

opposed to a placebo recorded significant improvement in their erection. 25% were able to complete full penetrative sex.

All men involved in the study suffered from severe and end stage erectile dysfunction and had no ability to perform sexual intercourse. In such cases the only option currently available to them is a costly penile prosthesis (surgical silicone implant).

A more extensive study is expected to be completed soon, which if it confirms the results of the pilot study, then it will truly revolutionise the ED treatment landscape.

Non PDE5-I oral agents

Newer pharmacological treatments are focused on targeting alternative pathways in the erectile process, both centrally and peripherally. Drug categories currently being investigated for ED include the following:

- Dopaminergic agents
- Melanocortin receptor agonists
- Soluble guanylate cyclase stimulators and activators
- Rho-kinase inhibitors

Stem cell transplant

Stem cell therapy is a new, experimental treatment option that offers the potential to reverse the underlying causes of ED and

reduce patient reliance on the transitory effects of PDE5-I medications. It has been studied in several animal models in subjects who poorly respond to PDE5-Is (cavernous nerve injury and DM). Stem cell regenerative therapy is based on the rationale that stem cells can differentiate into a wide variety of cells including endothelial cells, Schwann cells, smooth muscle cells, and neurons. Moreover, it is hypothesized that stem cells have beneficial effects on damaged or diseased tissues by releasing various molecular mediators, which lead the host tissue to initiate a regenerative or healing response to diseased or injured tissue responsible for ED.

The majority of published studies are based on animal models, but there has been one reported case series of seven men from Korea. In this study, all diabetic patients, with ages ranging from 57 to 87, were treated with an intracavernosal injection of umbilical cord blood stem cells. Morning erection was regained in six out of the seven men at 6 months from time of injection. With concomitant use of sildenafil, all of these men were able to obtain vaginal penetration. No adverse events were reported.

A more recent study reported on a phase I/II clinical trial of intracavernosal injection of stem cells in patients with post-prostatectomy erectile dysfunction. In the authors' sample size of 12 patients, they used escalating doses of stem cells and no serious side effects were noted. At 6 months, significant improvements of intercourse satisfaction and erectile function were noted in these patients. These results were preliminary and need to be confirmed in phase II trials.

Stem cell transplant therapy is a new frontier in medicine. Larger controlled studies are needed to show any potential benefit at the human level, and further investigation is paramount.

Gene therapy

Gene therapy is a potential therapeutic option that is another area of investigation for the treatment of ED. Genetic material can be easily injected into the penis, which is advantageous as this direct injection avoids potential systemic complications.

In the first human trial, patients were administered a single-dose cavernosal injection of hMaxi-K, a 'naked' DNA plasmid carrying the human cDNA encoding the gene for the alpha subunit of the human smooth muscle Maxi-K channel. No adverse events were noted in the 11 patients who received this therapy. Patients given the two highest doses of hMaxi-K had apparent sustained improvements in erectile function as indicated by improved IIEF domain scores over the length of the study.

This was a small study, but the encouraging safety profiles and effectiveness provide evidence that gene therapy is a viable option for the future. The role of stem cell regenerative therapy, in conjunction with gene therapy, will be heavily researched for the treatment of ED in the coming years.

We are monitoring this activity and our network is participating in all the forums that discuss the latest research led developments.

Supplements for Better Erections

A simple internet search will reveal that there are thousands of supplement products/brands that claim to improve your erections. Unfortunately, the vast majority of these are in the best case either completely ineffective or contain (illegally) PDE-5 inhibitors, which is the active ingredient of ED pills.

We caution any man considering buying ED supplements to be extra careful. Because supplements are not considered drugs, these are usually unregulated, produced in questionable facilities, with low manufacturing standards and often contain unlisted ingredients.

Another thing that you should bear in mind is that none of the supplements are likely to work better than ED pills. In some cases, there might have synergistic or complementary effects, but no supplements exhibit as high efficacy rates as PDE-5 inhibitors do.

Beyond these words of caution, we do believe that certain supplements, which you can buy without prescription, can help with your overall health and your erections, especially if you have low levels of the active ingredient.

It is also worth mentioning that most of the active ingredients of these supplements can be obtained through a wholesome diet or lifestyle (e.g. Vitamin D through increased sun exposure).

Because there are hundreds of potential supplements, in this section we will only present those that there is some level of evidence that they can help you. If you have come across a

specific supplement and are unsure about it then we recommend visiting www.examine.com , which is an excellent resource website dedicated to reviewing supplements.

Basic Supplements

Low levels of Vitamin D, Zinc or Magnesium have all been associated with impaired erections, low testosterone and in general poor health.

As such, we recommend checking your levels and consider supplementation if these are low. Having said that, getting more sun exposure will improve your Vitamin D levels as will eating whole foods, rich in minerals.

Supplements for Improved Endothelium Function

As explained in the previous sections, impaired endothelium function is one of the most common causes of erection problems and usually linked to advanced age and bad lifestyle.

There are various foods and supplements that can help improve endothelium function. The way the work is by increasing the concentration of proteins that the endothelium cells need in order to produce nitric oxide (NO), which in turn leads to increased blood flow to the penis.

- Vegetables high in nitrates

Nitrates are one of the reasons why vegetables are so good for you. Nitrates break down into nitrites, which circulate in the body

and are turned into nitric oxide. Nitrates, found abundantly in beetroot and a variety of leafy greens (arugula, collards, etc.), are a reliable and effective way to increase nitric oxide synthesis in the body.

A number of vegetables contain high amounts of dietary nitrate, with beetroot, celery, cress, chervil, lettuce, spinach, swiss chard, radishes, and rocket tending to have the highest concentrations.

There are no specific supplements for nitrates and they only way to get them is through a diet with significant amounts of nitrate rich vegetables.

- Garlic

Garlic consumption has been shown to have numerous cardiovascular health benefits. When it comes to erections, garlic can potentially improve NO signalling and thus improve endothelial function.

To maximize the benefits of garlic, eat 3–6 cloves daily over several meals. You should first cut or crush them, to activate their bioactive compounds, then cook them or eat them raw.

Supplementation can provide the same benefits. If you dislike the smell or taste of garlic, or if you wish to avoid the bad breath that comes from eating the cloves, take 600–1,200 mg of an aged garlic extract daily.

Too much garlic daily (12 cloves) or at once (6 cloves, or 1,200 mg of an aged garlic extract) could cause low blood pressure,

especially if taken with other hypotensive agents (including ED pills), and prolong bleeding time.

- Cocoa

The flavonoids in Cocoa can support NO levels and research shows that cocoa does improve blood flow.

Taking cocoa with other hypotensive agents (like PDE-5 inhibitors, garlic or nitrates) could cause low blood pressure, so caution is advised.

The standard daily dose for cocoa polyphenols is 1 g, which you can get by eating about 30 g of cocoa powder or 40 g of dark chocolate with a 75% cocoa content.

Neither milk chocolate nor white chocolate is a good source of polyphenols.

- Arginine and L-Citrulline

L-arginine is a popular supplement as it is touted to increase nitric oxide activity in the body. While there have been studies that have measured increased effects of nitric oxide (blood flow) they are paired with studies showing no net effects. As for the mechanism, there is reason to believe that this difference is in part due to poor absorption of L-arginine from the intestines before it can reach appreciable activity in the body.

L-Citrulline is another supplementation option because it is converted into arginine in the kidneys. It also has a better absorption rate. Citrulline is able to increase levels of plasma arginine more effective than arginine itself.

For this reason, supplemental L-arginine may be useful for instances where only an acute increase in required (e.g. before exercise) yet if higher serum arginine levels are wanted throughout the day (erectile dysfunction or cardiovascular health) citrulline would be preferable.

Supplements for Improved Testosterone Levels

As mentioned, Vitamin D, Zinc and Magnesium supplements can help boost testosterone levels.

Another hormone, dehydroepiandrosterone (DHEA) circulates throughout your body, where it can be called to make other hormones, notably testosterone and estrogens. Supplemental DHEA can support normal testosterone levels; this effect is especially reliable in case of age-related low testosterone. People with healthy hormone levels will see no benefit from supplemental DHEA.

Next Steps

The reality is that many men are reluctant to take the first step in resolving their ED issues either because of embarrassment or because they are unsure where to go.

Unfortunately, even if men talk to their GPs, it is quite common that they are just being prescribed an ED pill, have their issues dismissed as being in their head or are even told that ED is a normal part of ageing. It is in fact very rare that a man undergoes a proper medical evaluation and becomes aware of all the treatment options that are currently available, which have the potential to reverse your erection issues.

We hope that you have found this guide useful and as a first step we suggest that you follow the (slightly authoritative) advice that we give to all our patients:

- **Do not suffer in silence** - nowadays, all men suffering from ED are treatable – irrespective of the severity or the underlying causes;
- **You should take your ED issues seriously** - as they can be a very important overall health warning;
- **Don't delay treatment** - the longer you wait, the worse the problem will become; and

- **Take control of your general health** - Taking control of and actively improving your lifestyle (diet, exercise, sleep, stress) will go a very long way in improving your erections.