QRS 1010 Pelvicenter

Repetitive peripheral magnetic stimulation to correct functional pelvic floor disorders

Scientific documentation and medical information

Sexual Dysfunction: Erectile Dysfunction

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definition

The European guideline on the definition of impotence or erectile dysfunction (ED) describes the problem as follows: "ED is a persistent inability to both achieve and maintain an erection so that satisfactory sexual activity is possible".

Since the market launch of the potency booster Sildenafil, the once taboo topic has been attracting increasing interest for some time and has almost developed into a lifestyle topic in terms of "sexual performance". Unfortunately, these pills do not solve the problem or the cause of erectile dysfunction, because the complex cause cannot be cured purely with medication. ED thus remains of high medical relevance.

Epidemiology and Prevalence

The prevalence data differ considerably due to socio-economic differences in the individual cultures [1] , [2] . According to the NIH consensus conference, the prevalence is 1.9% in 40-year-olds and 65% in men at 65 [3] . In Germany, a frequency of 40% is given for 65 to 70 year olds [4] .

Other sources estimate ED at 2.3% for those aged 30 to 39, 0 to 9.5% for those aged 40 to 49, 2 to 30.8% for those aged 50 to 59, and 15 to 76% for those over 70 -year-olds [5] , [6] , [7] , [8] . Finally, in the representative Massachusetts Male Aging Study (MMAS), 52% of the men surveyed stated that they were at least temporarily affected by erectile dysfunction. The dysfunction was minimal in 17.2%, moderate in 25.2% and completely pronounced in 9.6% [9] .

It is also important to distinguish between an inflow and an outflow disturbance. The proportion of venous outflow disorders in an ED is 25 to 86% [10] or, according to other sources, 20 to 28% [11] , [12] . If you examine with an incorruptible Doppler ultrasound, the proportion is 43%. According to these data, the main cause of ED seems to be less arteriosclerotic than to consist primarily of a venous leak.

According to an analysis of the world database, it can be assumed that there are around 169 million men worldwide with erectile dysfunction [13] . In Germany there are said to be 3 to 7 million people affected [14] . In 2025, an ED prevalence of > 300 million men is expected worldwide [15] .

physiology

The picture of a primarily psychogenic erectile dysfunction has changed to a predominantly organic disease due to new diagnostic and therapeutic options [16] , [17] , [18] , [19] , which is said to account for up to 80% of all EDs [20] . However, the interaction of often psychological and organic factors is undisputed.

Smoking also has a major impact, since the substances contained in cigarette smoke, such as carbon monoxide, benzopyrene, glycoproteins and crack products, have a direct toxic effect on the vascular endothelium (“endothelial dysfunction”). Compared to non-smokers, the risk increases by about a third [21] . This goes hand in hand with other cardiovascular diseases, such as an ED risk increase of 36% in the case of

hypertension or a doubling of the risk with a BMI of > 28. The feared vascular changes in diabetes mellitus are said to increase the ED risk even fourfold [22] - which the MMAS study contradicts with 28% compared to 10% in the general population. However, one of the main "causes" of ED is the aging process.

The most important part of the penis for an erection is the erectile tissue (corpora cavernosa), which consists of an arterial and venous network of vessels. They are to be understood as countless cavities lined with endothelium (sinusoids / lacunae), which are traversed by a framework (trabecula) of connective tissue fibers and smooth muscle cells like a “sponge” [23] . During a penile erection, which can be triggered both psychogenically and reflexively as a neurovascular process, the smooth muscle cells in the arterioles relax after the release of relaxing messenger substances, which opens the blocking arteries (arteriae helicinae).

Due to the increased inflow of blood, which can be up to 700% compared to resting perfusion [24] , the sinusoids or cavities expand and end in an erection. Due to the now greatly increased pressure, the venous plexus and the Vv. Emissariae lying under the tunica albuginea are compressed, which blocks the venous drainage [25] . This mechanism, in which the intracavernous pressure rises to about 100 mg HG (“higher than the diastolic blood pressure”), is called the veno-occlusive system [26] . The volume of the erectile tissue has increased three to four times.

In the flaccid, non-erect state, there is only an oxygen partial pressure of between 25 and 40 mmHG in the penis, which can be described as hypoxic [27] , [28] , while an erection produces partial pressures of 90 to 100 mmHG. However, this is of crucial importance for the functionality of a penis, since low oxygen partial pressure reduces the growth of smooth muscle cells in favor of connective tissue (collagen) [29] .

Nocturnal erections are of great importance here. These increase up to the age of 20 and decrease again from the age of 35, whereby a healthy young man develops between four to six spontaneous nocturnal erections, each lasting between 20 and 50 minutes [30] . This strong blood flow to the cavernous body, which is about 2 to 3 hours a day, leads to a corresponding oxygenation and an increase in the oxygen partial pressure. In a figurative sense, this nocturnal cavernous body training can be compared to cardio training (“jogging three times a week”) [31] .

The ratio of smooth muscle cells to connective tissue of the corpus cavernosum is 50:50 in young, potent males [32] . More precisely, the erectile tissue consists of 46% smooth muscle cells [33] and 48% connective tissue (collagen) [34] .

From the age of 40 to 60, the proportion of smooth muscle cells usually drops to 40% and even to 35% in those over 60 [35] . The associated collagen proliferation ends in a state of fibrosis [36] . In the case of an "erection attempt", increasing fibrosis of the erectile tissue prevents tissue expansion and thus creates the classic case of erectile dysfunction [37] , [38] .

Venous Leak

In the case of a venous leak, the erectile tissue elasticity is usually reduced as a result of fibrosis. As a result, the veins running between the bodies of the lacunae are no longer sufficiently compressed due to the insufficient lacunar expansion and are no

longer pressed strongly enough against the inner tunica albuginea in the further course. There are patients who achieve a full erection, but the rigidity disappears within seconds. Still others report a decrease in erection with certain leg movements or even an increase in certain postures [39]. This reinforces the suspicion that the compression pressure of the ischiocavernosus (MIC) muscle has an influence.

In fact, the pelvic floor muscles or the MIC, which encloses the base of the erectile tissue by 35 to 56% [40], plays an important role in maintaining an erection [41], [42], [43]. Through voluntary or reflex contraction, the venous outflow at the roots of the cavernous bodies can be throttled in such a way that the pressure in the cavernous bodies rises to suprasystolic values [44], [45], [46]. In one extreme case, the erectile tissue pressure measured was 10 times the systolic blood pressure (120 mm HG), i.e. an enormous 1,200 mm HG [47].

Some patients are able to develop pressure above > 100 mmHG even if they have veno-occlusive dysfunction [48]. A contraction of the bulbospongiosus muscle (MBS) also leads to at least a temporary throttling of the blood flow from the glans penis and the corpus spongiosum and thus increases the intraspongial pressure [49], [50].

conservative therapies

In addition to drug treatment with phosphodiesterase inhibitors (e.g. sildenafil), which regardless of the cause of ED aims less at curative than at functional improvements, operative procedures as well as active pelvic floor training or transcutaneous perineal electrostimulation are available for venous leaks. However, surgical vein resection or
percutaneous transpenile venous embolization is disappointing with a relative success rate of around 20% (long-term observation) [51]. The option of active pelvic floor training is primarily about strengthening the MIC, for which only a limited amount of valid data is available.

This could, for example, be related to the fact that due to the easy availability of Viagra® and colleagues, with a simultaneous lack of understanding of the connections between venous drainage disorders, the motivation to win men with ED for a relatively lengthy pelvic floor training (6 to 12 months) is rather low. There are also only a few studies on the relevance of electrical stimulation, although the application site (perineum or penis) also differs.

The contractile strength of potent men after prolonged pelvic floor training is significantly higher than those who started with ED, or the other way around, pelvic floor contractility is negatively correlated with age [52]. This leads to the logic that pelvic floor exercises are more effective in sexually potent men than in impotent elders.

In another study [53], subjects were asked to contract their perineal muscles during an artificially induced erection. The authors observed two erection phases: In phase 1 (“slight erection”), the CCP pressure (corpus cavernosum pressure) remained in the range of the systolic blood pressure. Once phase 2 was reached (“complete erection”), the CCP pressures rose to > 400 mmHG. Such suprasystolic pressure ratios have also

been reported in other studies [54] , [55] . The duration of the maximum CCP pressure corresponded exactly to the contraction of the MIC determined by EMG. Ergo, the MIC seems to be decisive for suprasystolic values of the erectile tissue and for a hard erection.

QRS Pelvicenter rPMS effect

Since penile inflow disorders and an age-related decrease in nocturnal erections (“hyperoxia training”) consequently end in fibrosis of the cavernous bodies, which in turn results in insufficient filling of the cavernous bodies and a venous leak, different actions are required for effective ED treatment.

First of all, as an "emergency measure", the actual "safety system" in the form of the M. ischicavernosus (MIC) and (to a lesser extent) also the M. bulbospongiosus should be returned to the old compression strength in order to increase both the penile filling pressure and for create a venous outflow blockage.

Unfortunately, with increasing age there is a decreasing ability of the pelvic floor to contract voluntarily, which is also influenced by concomitant diseases such as diabetes, atherosclerosis or neuropathies [56] . However, it is no less important to act directly on the cavernous fibrosis, which is only possible by increasing penile blood pressure.

Based on a large number of studies (> 100) on rPMS training for incontinence treatment, rPMS is one of the most effective methods for not only achieving a cross-sectional enlargement of the pelvic floor muscles and thus also the MIC [57] , [58] , but also also to strengthen the local representation in the somatosensory cortex via the increased propriceptive (afferent) influx into the CNS ("activation of lost, cortical reorganization processes").

These changes in the primary motor cortex can be visualized with positron emission tomography [59] , [60] , [61] and cause an increased reflex response of the associated peripheral muscles. Since rPMS practically only depolarizes thick, myelinated nerve fibers, ie does not activate the thin fibers for nociception [62] , it offers complete freedom from pain compared to transcutaneous electrical stimulation [63] , [64] . The QRS Pelvicenter generates rPMS stimuli that are similar to endurance training [65] .

The treatment of cavernous fibrosis is to be seen completely differently. In order to initiate a conversion of the collagenous erectile tissue fibers into smooth muscle tissue, an increased penile oxygen partial pressure alone is decisive. At least animal experiments have shown that stimulation of the pudendal nerve, which causes the musculus ischiocavernosus to contract, causes the perineum and the penile area to rise to suprasystolic values [66] and thus, for example, prevents apoptosis of smooth muscle cells.

A stimulation of the pudendal nerves is already known from the rPMS treatment of urge incontinence or instability of the detrusor [67] , [68] , [69] , [70] , [71] . In contrast to MIS muscle training, which requires an effective field application at the

level of the perineum, fibrosis treatment should be carried out closer to the os-sacrum.

Scope of treatment and duration of therapy

While active pelvic floor training has to be carried out over many months, 16 to 20 sessions within 6 to 8 weeks on the QRS Pelvicenter are sufficient to achieve a lasting result in terms of muscle strengthening and cortical representation.

The stimulus configuration required for this corresponds to the setting parameters in the treatment of stress incontinence. Fibrosis treatment using rPMS, however, requires a longer treatment period, since the necessary conversion processes can only be initiated by a constantly recurring increase in the oxygen partial pressure. A different stimulus configuration must also be selected in the frequency settings because the pudendal nerve responds optimally to high frequencies [72] .

expectation of success

The probability of success of rPMS treatment for erectile dysfunction can be derived from the results of active pelvic floor training. The QRS Pelvicenter rPMS has a disproportionately stronger effect on a muscle cross-section enlargement and thus a cortical representation. The expectation of success in cavernous fibrosis cannot yet be quantified because of the experimental nature of the use of rPMS.

study situation

We are currently unable to present any valid or study-based data on the success of rPMS treatment in ED (“training the MIC”). In our own application observation, however, good results have emerged. Particularly good results have been found in improving the performance of potency.

Example study 1: In a basic study [73] , ED patients with an average age of 46 years (25 to 61 years) were treated with pelvic floor training, biofeedback and electrical stimulation over a period of 4 months. Most had either veno-occlusive dysfunction or mixed arterial and venous problems, hardly any had arterial inflow disorders.

Result:

47% achieved a normal erection again, in 24% the symptoms improved and in 12% the procedure had no effect. Of particular note is that 75% of the participants in the veno-occlusive group were able to perform normal VR again. This result is comparable to some studies from the 1990s [74] , [75] , [76] and was achieved regardless of age and previous duration of ED.

Example study 2: In a cross-over study [77] , 55 ED patients either undertook pelvic floor exercises with biofeedback and lifestyle changes over 3 months, or only lifestyle changes (control group). After these 3 months of guided training, the participants had to train alone at home for 3 more months.

Result:

After 3 months verum showed significant improvements compared to the control group. The latter reacted identically after the crossover change after a further 3 months. After 6 months, 40% of the participants had regained normal erectile function and 35.5% had improved. The training had no effect in 24.5%.

Study 3: A year earlier, the same author had already conducted a study [78] with a similar study design. Here the results were 40% (fully rehabilitated), 34.5% improved and 25.5% without improvement.

Study 4: Another unpublished study [79] refers to “sexual performance”, since the test subjects consisted not only of mild cases of ED, but also of men with healthy erections. The 4-week baseline program (“Private Gym Pelvic Floor Muscle Training Program”) consisted of a combination of progressive pelvic floor muscle contractions for 3 repetitions, 3 to 4 times per day. This was followed by “penile resistance” training for a further 8 weeks.

Result:

After 12 weeks, the angle of rise of the penis when the pelvic floor was contracted improved by 14 degrees in the active group and by 19 degrees in the control group. The maximum angle of ascent was 23.9 seconds in the verum group. be held, while this was only 7.5 seconds in the control group. was possible. In IIEF-6, the following parameters improved in the verum group: erectile strength (68%), intensity of orgasm (68%), ejaculation power (48%), sexual self-image (80%) and sexual desire (72%). In the control group these were 33%, 33%, 0%, 0%, 0% and 25%. Accordingly, not only does ED benefit from special pelvic floor training, but also general sexual performance (better erection and ejaculation) in healthy men without ED.

A review [80] again confirms the relevance of a strong pelvic floor (MIC and MBS) and the need for pelvic floor training in ED - also to increase "sexual performance".

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summary

Although arteriosclerotic changes are to be regarded as the classic gateway for erectile dysfunction, fibrosis of the cavernous bodies seems to be decisive in the end. With insufficient oxygenation of the cavernous bodies, which is mainly caused by an age-related decrease in nocturnal erections, the smooth muscle tissue, which is so important for the expansion of the cavernous bodies, is reduced in favor of connective tissue.

However, the insufficient expansion of the erectile tissue creates insufficient pressure on the draining veins, so that in the event of an attempt at erection, increased blood drainage from the penis cannot be prevented ("venous leak"). Although this can be more or less counteracted, for example, with so-called phosphodiesterase inhibitors (Sildenfil & Co.), this is not a curative measure, but only a function-improving measure that does not get better with increasing age.

Here, the musculus ischiocavernosus (MIC) is
of crucial importance, because its contraction creates a compression pressure that can effectively throttle the premature venous outflow of blood from the penis.

Targeted MIC and MBS training can be carried out with an rPMS, especially since the QRS Pelvicenter not only makes it possible to carry out an exact positioning of the field of action ("adjustable snowmobile"), but also a tetanus stimulation that is favorable in terms of sports physiology To achieve a training effect that is higher than that of active pelvic floor training.

Fibrosis can also be counteracted with rPMS, since stimulation of the pudendal nerves can lead to an increase in penile blood flow. The associated increased oxygenation has a beneficial effect on the relationship between connective tissue and smooth muscles in the erectile tissue.

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