ERECTILE DISFUNCTION

Definition :

The European guideline for defining impotence or erectile dysfunction (ED) describes the problem as follows: "Erectile dysfunction is a persistent failure to achieve and maintain an erection for a satisfying sexual act."

Since the market launch of Sildenafil, the first taboo subject has been attracting increasing interest for a long time and has almost become a lifestyle topic in the aspect 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 medically. Thus, ED continues to be of high medical interest.

Epidemiology and prevalence :

Prevalence data differ in some cases considerably due to socioeconomic differences of different cultures [1] , [2] . According to the NIH Consensus Conference, the prevalence is expected to be 1.9% in 40-year-olds and 65% in men over 65 [3] . In Germany, for 65-70 year olds, a frequency of 40% is called [4] . Other sources estimate DE at age 30–39 with 2.3%, 40–49 with 0–9.5%, 50–59 with 2–30.8%, and 15–76% with over 70 years. years [5] , [6] , [7] , [8] . Finally, in the prestigious Massachusetts Men's Aging Study (MMAS), 52% of men surveyed said they were at least temporarily affected by erectile dysfunction. Dysfunction was minimal at 17.2%, moderate at 25.2%, and completely pronounced at 9.6% [9] .

The distinction between an influx or an influx is also important. Thus, the proportion of venous drainage disorders in an ED is 25 to 86% [10]. or, according to other sources, from 20 to 28% [11] , [12] . If you study with an incorruptible Doppler ultrasound, the proportion is 43%. According to these data, the main cause of erectile dysfunction seems to be less arteriosclerotic than the main consequence of venous leakage. According to an analysis of the Global Database, approximately 169 million men with erectile dysfunction should be presumed [13]In. Germany, there are expected to be 3-7 million people affected [14] . In 2025, a prevalence of erectile dysfunction in excess of 300 million men worldwide is expected [15] .

Physiology :

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

to have a major influence after the substances contained in cigarette smoke, such as carbon monoxide, benzpyrene, glycoproteins and crackers, had 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 the increased risk of ED by 36% in hypertension or the risk of doubling with a BMI of > 28. The dreaded vessel changes in diabetes should even increase ED risk [22] - which the MMAS study however contradicts with 28% against 10% in the total population. However, the aging process is one of the most important "causes" of erectile dysfunction.

The most important part of penile erection is the corpora cavernosa, consisting of an arterial and venous vascular network. They should be understood as countless endothelial cavities (sinusoids / lacunae), crossed by a framework (trabeculae) of connective tissue fibers and smooth muscle cells like a "sponge" [23] . In an erection of the penis, which can be triggered both psychologically and reflexively as a neurovascular process, the smooth muscle cells of the arterioles relax after the release of relaxing messengers, which opens the arterial arteries (arteriahelicinae). The increase in blood flow, which can reach 700% compared to resting perfusion [24] , dilates sinusoids or cavities and ends in an erection. Due to the now greatly increased pressure, the venous plexus underlying the tunica albuginea and the emissaries Vv. Are compressed, which blocks venous flow [25] . This mechanism, in which the intracavernous pressure reaches about 100 mg HG (“above diastolic blood pressure”), is called the veno-occlusive system [26]. . The cavernosum volume increased three to four times.

In the soft, unexcited state, there is a partial pressure of oxygen in the penile erectile tissue of between 25 and 40 mmHG, which can be termed hypoxic [27]. , [28] , while an erection produces partial pressures of 90 to 100 mmHG. However, this is crucial for penile function because the partial pressure of oxygen reduces the growth of smooth muscle cells in favor of connective tissue (collagen) [29] . Nighttime erections are very important here. These increase until the age of 20 and decrease from the age of 35, with a healthy young man developing between four and six spontaneous nocturnal erections lasting between 20 and 50 minutes [30] . This strong body circulation, which is therefore daily at around 2 to 3 hours, leads to a corresponding oxygenation and a respective increase in the oxygen partial pressure. This nocturnal cavernous exercise is comparable to cardiovascular training ("jogging three times a week") [31] .

The ratio of smooth muscle cells to connective tissue in the corpus cavernosum is 50:50 in powerful young men [32] . Specifically, the corpora cavernosa are composed of 46% smooth muscle cells [33] and 48% connective tissue (collagen) [34] . From 40 to 60 years old, the proportion of smooth muscle cells generally drops to 40% and even more than 35% to 35% [35]The concomitant proliferation of collagen ends in a state of fibrosis [36] . In the case of an “erection test”, an increasing fibrosis of the cavernous tissue prevents tissue expansion and thus creates the classic case of erectile dysfunction [37] , [38] .

Venous leakage :

In a venous leak, body elasticity is usually reduced as a result of fibrosis. Thus, the veins passing between the Lakunenkörpern are no longer sufficiently compressed due to the lack of lacunar expansion and also because they are not sufficiently compressed against the inner Tunicaalbuginea. So there are patients who achieve a full erection, but the rigidity disappears in a few seconds. Others report a loss of erection in certain leg movements or even an increase in certain postures [39] . This confirms the suspicion that the compression pressure of the M. ischiocavernosus (MIC) probably influences it.

This is because the pelvic floor muscles or MIC, which surrounds the base of the body swelling to 35-56% [40] , play an important role in erectile function [41] , [42] , [43] By intentional or reflex contraction, the venous outflow at the corpora cavernosa can be constricted so that the caverno-skeletal pressure increases to supersystolic levels[44] , [45] , [46] . In an extreme case, even cavernous pressure was measured at 10 times systolic blood pressure (120 mm HG), which is a whopping 1200 mmHG[47] . Part of the patient develops a pressure of >100 mmHG, even though there is veno-occlusive dysfunction [48] . A contraction of the bulbous spongy muscle (MBS) also results in at least a temporary reduction in blood discharge from the penis glans and corpus spongiosum, thereby increasing intraspongial pressure[49], [50] . .

Conservative therapies :

In addition to drug treatment with phosphodiesterase inhibitors (eg sildenafil), which is aimed less at curative than functional improvements, there is venous leak surgery, active pelvic training or transcutaneous perineal electrostimulation. Surgical venous resection or percutaneous transpenile venous embolization is disappointing with a relative success rate of about 20% (long-term observation) [51] . The option of active training on the pelvic floor is mainly to strengthen the MIC, for which, however, only a limited amount of valid data is available.

This could be related, for example, to the fact that Viagra® and its colleagues are readily available, while not understanding the relationships between venous drainage disorders. The motivation is rather low to win a relatively long pelvic floor training (6-12 months). There are only a few studies on the relevance of electrostimulation, although here too the site of application (perineum or penis) differs.

Powerful men's contraction force is significantly higher after prolonged pelvic floor exercise than in those who started ED, or conversely, pelvic floor contraction capacity is negatively correlated with age [52] . . This leads to the logic that pelvic floor training is more effective in sexually powerful men than in impotent older people.

In another study, [53] subjects were asked to contract their perineal muscles during an artificially created erection. Two episodes of erection were observed by the authors: In phase 1 ("mild erection"), the pressure of the CCP (body pressure

cavernous) remained within systolic blood pressure limits. When phase 2 was reached ("full erection"), CCP pressures increased to >400 mmHG. Such suprasystolic pressure ratios have also been reported in other studies [54]. , [55] .

The duration of the maximum pressure CCP coincided exactly with the contraction of the CMI determined by EMG. Thus, CMI appears to be crucial for suprasystolic sclerosis or a hard erection.

Pelvicenter rPMS QRS effect :

After penile influx and age-related decrease in nocturnal erections ("hyperoxia training"), bodily fibrosis results which leads to inadequate cavernous filling and venous leakage.

Firstly, in the sense of an "emergency measure", the "ischicavernous" (MIC) muscle regimen and, to a lesser extent, bulbospongiosum is attributed to the former resistance to compression to improve both the pressure of filling of the penis and to ensure blockage of venous drainage. Because, unfortunately, there is a decrease in the capacity of the pelvic floor with age, which is also influenced by comorbidities such as diabetes, atherosclerosis or neuropathies [56] . However, it is important to act directly on the Schwellkörperfibrosis, which is only possible by increasing the blood pressure of the penis.

Based on a large number of studies (>100) on rPMS training for the treatment of incontinence, rPMS is one of the most effective methods for achieving not only transverse enlargement of the pelvic floor muscles and therefore also the MIC [57] , [58] Strengthen local representation in the somatosensory cortex via increased proprietary (afferent) influx into the CNS ("activation of lost cortical reorganization processes"). These changes in the primary motor cortex can be visualized by positron emission tomography [59] , [60] , [61] and cause an increased reflex response of associated peripheral muscles. As rPMS practically only depolarizes thick and medullated nerve fibers, i.e. does not activate thin fibers for nociception [62] , it is completely pain-free compared to transcutaneous electrostimulation [63] , [64] . The rPMS QRS PelviCenter generates stimuli similar to endurance training [65] .

The treatment of body fibrosis is completely different. In order to initiate a transformation of body fibers into collagen into smooth muscle tissue, only an increased partial pressure of penile oxygen is decisive. Thus, at least in animal experiments, it can be shown that stimulation of the pudendal nerve, under which the ischiocavernous muscle contracts, causes the perineum and penis to rise to supersystolic levels[66] thus preventing muscle cell apoptosis . smooth. Pudendal nerve stimulation is already known through rPMS treatment of urge incontinence or detrusor instability[67] , [68] , [69] , [70] , [71] .
Unlike CMI muscle training, which requires effective field application at the perineum, fibrosis treatment is most effective near the Bone-Sacrum.

Treatment scope and treatment period :

Although active pelvic floor training is required over several months, 16 to 20 sessions of 6 to 8 weeks on the QRS PelviCenter are enough to achieve a lasting result in terms of muscle strengthening and cortical representation. The stimulus configuration required for this corresponds to adjustment parameters in the treatment of stress incontinence. However, a treatment of fibrosis by means of rPMS requires a longer treatment period, since the necessary remodeling processes can only be initiated by a constant increase in the partial pressure of oxygen. In this case, another stimulus configuration in the frequency settings should be chosen because the pudendal nerve responds optimally to high frequencies [72]. .

Expectation of success :

The likelihood of successful rPMS treatment for erectile dysfunction can be inferred from the results of active pelvic floor training. The QRS PelviCenter rPMS has a stronger effect on transverse muscle enlargement and thus cortical representation. The expectation of success in body fibrosis is not yet quantifiable due to the experimental nature of the use of rPMS.

Place of study :

At this time, we cannot provide valid or study-based data on the success of rPMS therapy in the treatment of ED ("Training the MIC").
However, good results have been found in the application's own observation. Particularly good results resulted in improved potency performance.

Study example 1: In an initial study [73] , ED patients with a mean age of 46 years (25 to 61 years) were treated for 4 months with pelvic floor training, biofeedback and electrical stimulation. Most had either veno-occlusive dysfunction or mixed arterial and venous problems, virtually no one had arterial flow disorders.

Result:

47% regained a normal erection, in 24% the symptoms improved, and in 12% of cases the procedure was ineffective. Of particular note is the veno-occlusive group: 75% of participants were able to perform a normal GV again. This result is comparable to some studies from the 1990s [74]. , [75] , [76] and was performed independent of age and duration of erectile dysfunction.

Example 2: In a crossover study [77] , 55 patients with erectile dysfunction performed pelvic floor training with biofeedback and modification of the

lifestyle for 3 months or limited to lifestyle changes (control group).
After these three months of guided training, the participants had to train alone for three months at home.

Result:

At 3 months, Verum showed significant improvements over the control group.
The latter responded identically after the filter change after an additional 3 months. At 6 months, 40% of participants regained normal erectile function and improved by 35.5%. At 24.5%, training was ineffective.

Study 3: A year earlier, the same author had already conducted a study [78] with a similar study plan. Here the results were 40% (fully rehabilitated), 34.5% improved, and 25.5% unimproved.

Study 4: Another unpublished study [79] refers to "sexual performance", the test subjects being not only cases of mild erectile dysfunction, but also men with healthy erections. The 4 weeks ("Private Gym Pelvic Floor Muscle Training Program") consisted of a combination of increasing contractions of the pelvic floor muscles with 3 reps 3-4 times a day. This was followed by "penile resistance" training for another 8 weeks.

Result:

After 12 weeks, the elevation angle of the penis when the pelvic floor became tense improved by 14 degrees in the verum group and 19 degrees in the control group.
The maximum elevation angle was in the verum group 23.9 Sec. While in the control group, this is only 7.5 seconds, was possible. In IIEF-6, the following parameters improved in the verum group: erectile strength (68%), orgasm intensity (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%. As a result, special pelvic floor training not only benefits erectile dysfunction, but also general sexual performance (better erection and ejaculation) in healthy men without ED.

A review [80] confirms once again the relevance of a powerful pelvic floor (CMI and MBS) or the necessity of pelvic floor training in ED - also to increase sexual performance.

Summary :

Although arteriosclerotic changes are a classic gateway to erectile dysfunction, fibrous fibrosis appears to be crucial. Inadequate oxygenation of the corpora cavernosa, mainly due to age-related decrease in nocturnal erections,

reduces smooth muscle tissue, so important for the expansion of the cavernous body, in favor of connective tissue. The insufficient expansion of the erectile tissue, however, again only produces insufficient pressure on the laxative veins, so that in the case of an erection test, an increase in penile blood flow cannot be prevented ("venous leak"). Although the phosphodiesterase inhibitor (Sildenfil & Co.) is more or less satisfactory, it is not a curative measure but an improvement in function which does not improve with age.

This is where the ischiocavernosus muscle (ICM) plays a crucial role, as its contraction creates compressive pressure that can effectively slow premature venous blood flow out of the penis.

With an rPMS, targeted MIC and MBS training is possible, especially since the QRS PelviCenter allows not only to position exactly the effective field ("adjustable coil"), but also the mechanism of action of a tetanus stimulation physiologically favorable To achieve a higher training effect than active pelvic floor training.

rPMS can also be used to combat fibrosis, as stimulation of the pudendal nerves leads to increased penile blood flow. The associated increased oxygenation has a favorable effect on the relationship between connective tissue and smooth muscle in erectile tissue.

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