QRS 1010 Pelvicenter

Repetitive peripheral magnetic stimulation to correct functional pelvic floor disorders

Scientific documentation and medical information

Basics: The rPMS with the QRS Pelvicenter

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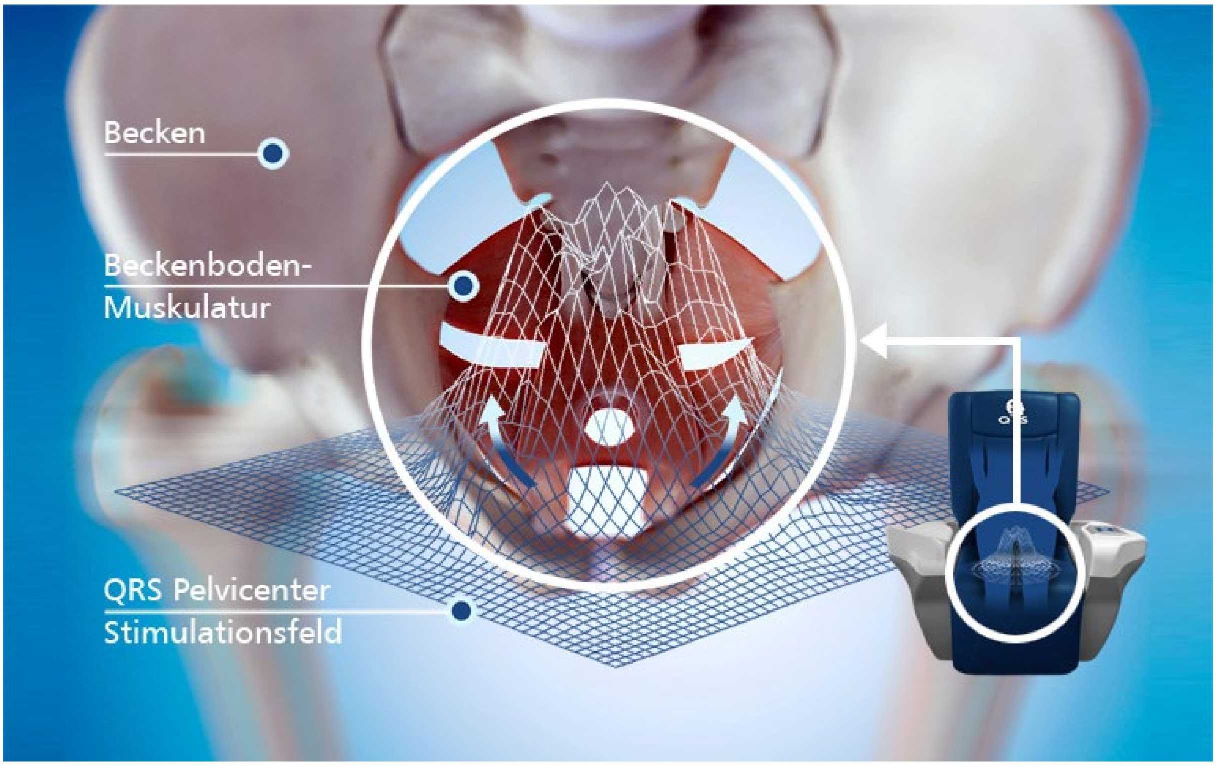
The QRS Pelvicenter rPMS combines the therapy methods "electrostimulation" and "pelvic floor training"

The QRS 1010 Pelvicenter, also known as a magnetic chair, is a highly efficient muscle stimulator for neuromuscular therapy of a weakened pelvic floor or its degenerated muscles and their negative consequences.

The overarching family of procedures is referred to as PMS (Pulsed Magnetic Stimulation). The therapy method is NOT comparable to classic magnetic field therapy (PEMF). The technical term "rPMS" (repetitive peripheral magnetic stimulation) describes the procedure itself.

Based on the physiological properties of classic pelvic floor training, the strengthening effect is realized via an electromagnetic field. This field of action, which can be adjusted up to maximum strength, stimulates the motor nerves and generates a large number of contractions, i.e. muscle-tensing movements. In contrast to classic pelvic floor training, these muscle contractions are not deliberately generated by the patient and cannot be influenced by the patient.



Graphic: Representation of the "stimulation effect" of the QRS Pelvicenter rPMS signal on the multi-layered pelvic floor muscles.

The QRS Pelvicenter rPMS method is comparable to electrostimulation and classic pelvic floor training, but the rPMS is superior.

The proven effect of pelvic floor training and vaginal or rectal electrostimulation is combined in one therapy method with the QRS Pelvicenter rPMS. Because the QRS Pelvicenter rPMS is fundamentally based on the physiological properties of classic pelvic floor training and the technical principles of electrostimulation. Both therapy methods are recognized in the professional world. This is also supported by the guidelines on bladder dysfunction.

The QRS Pelvicenter rPMS turns out to be a dynamic symbiosis of two recognized therapy methods, with significant advantages that are essential for rapid therapy success.

Why is the QRS Pelvicenter rPMS method superior?

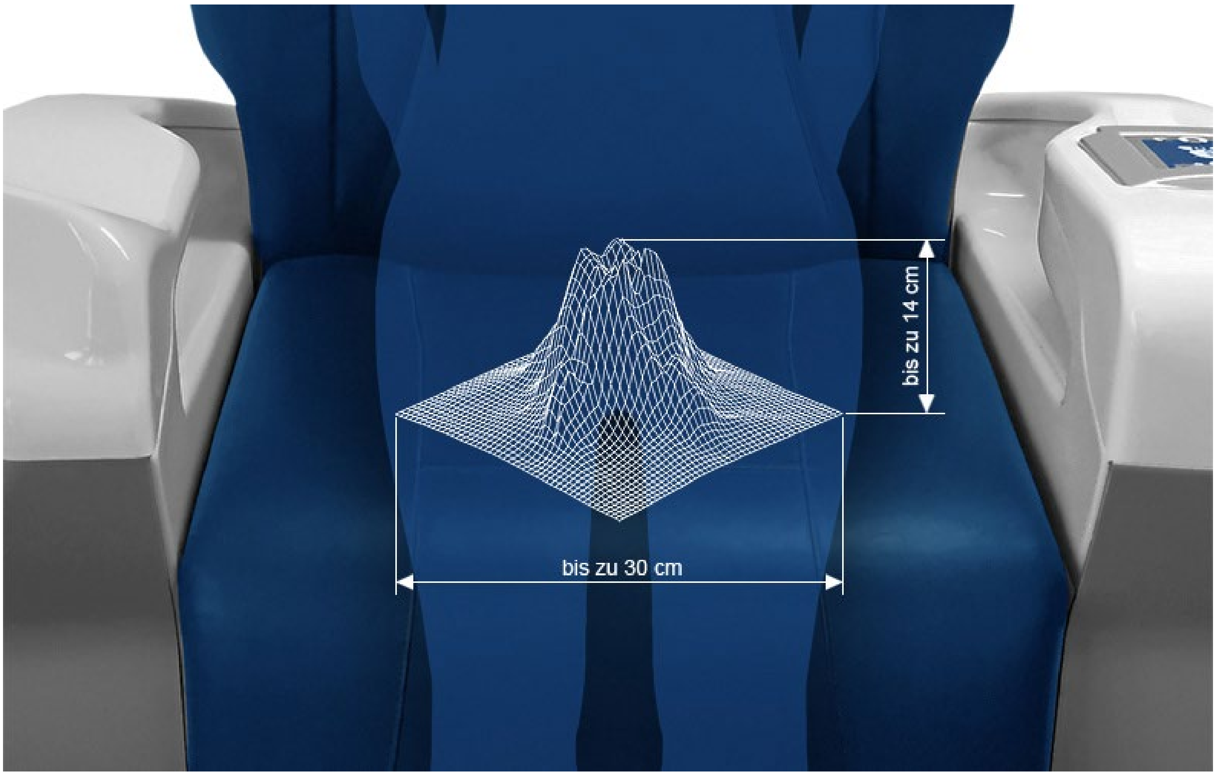
1. Compared to electrostimulation, rPMS uses a more innovative type of current transmission.

Because the magnetic field is a sophisticated, non-contact "transmission medium", similar to modern wireless charging or inductive charging (wireless electromagnetic charge induction).

The major disadvantage of electrostimulation is that there is always a high (ohmic) resistance from skin, muscle and bone tissue, so that a voltage drop is inevitable. This voltage drop must be compensated for by higher current densities. However, above a certain stimulus threshold, this increase leads to unpleasant pain effects for the patient. Since above a certain level of current the pain becomes tormenting for the patient and can no longer be endured, the penetration depth of the electrostimulation is limited.

Many patients find the insertion of an electrode probe (vaginal or rectal) uncomfortable. In addition, the insertion of a probe is often viewed as infringing on privacy!

Both the problem of the penetration depth and the insertion of the probe can be avoided extremely effectively with a QRS Pelvicenter magnetic stimulation using the principle of electromagnetic induction. After the impulses penetrate deeper into the tissue and therefore cannot activate pain and mechanoreceptors in the skin, QRS Pelvicenter rPMS therapy is painless [1], [2].



Graphics: The impressive, maximum range of the effective field at the highest intensity is up to 30 cm wide and up to 14 cm deep.

The penetration depth is also related to the spread of the spatial field distribution: While the magnetic field depends on the ionic environment of a tissue and thus penetrates deeper into the muscle tissue, an electric field chooses the path of least resistance - which, however, is very fast due to the higher resistance of the deeper tissue is finished. At the target location, i.e. where nerves cause the muscles to contract, the QRS Pelvicenter rPMS triggers the same effect as electrostimulation! But the transmission stimulus of the electric current via the skin is obsolete and thus the stimulation intensity in the depth of the muscles is significantly stronger.

2. Compared to classic pelvic floor training, the success of the therapy does NOT depend directly on the patient's motivation or any physical limitations that may exist.

The greatest risk of active pelvic floor training is that patients who do not have sufficiently functional pelvic floor muscles or cannot perceive them, mistakenly contract the "auxiliary muscles" stomach, buttocks and thighs during training to compensate (faulty feedback). If the therapist cannot remedy the situation by training the misuse of the counterproductive auxiliary muscles, the success of the therapy will be significantly weakened or eliminated. The result can be a consecutively decreasing motivation and therapy adherence up to the termination.

In addition to a lack of adherence, physical and/or mental mobility limitations on the part of the patient, especially in the later stages of life, are associated with reduced or no therapeutic success.

The requirements for rPMS are different: In a comfortable, sitting position in the QRS Pelvicenter, the treatment does not require any strenuous, physically controlled activities or voluntary control. A "wrong" training with consecutive "faulty feedback" is excluded.

Non-contact stimulation is usually carried out in everyday clothing. This means that changing clothes or undressing is no longer necessary!

The decisive perception training of the pelvic floor muscles at the beginning of a guided pelvic floor training is either omitted, or if desired by the therapist, the perception phase can be significantly shortened by using the QRS Pelvicenter.

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rPMS – stimulus transmission to muscle cells

The electrical stimulus is transmitted to the muscle via the so-called motor endplate.

Explanation of the motor endplate:
The motor endplate corresponds to a chemical synapse or a gap of 20 to 50 nm, on one side of which the terminal boutons of the motor nerve are located and on the other side a membrane section of the muscle cells. If a nerve stimulus arrives, the neurotransmitter acetylcholine is ejected in the synapse cleft and received by certain (nicotinic) receptors. Both the end knobs and the membrane are folded up so that the signal transmission increases due to the increase in surface area.

The axon of the nerve cell branches off in the perimysium (layer of connective tissue surrounding muscle fibers). The larger the branches, the more muscle fibers can be supplied. A motor nerve fiber innervates 3 to 2,000 muscle fibers (“motor unit”), depending on the number of its branches, depending on whether the muscle group works more gross or fine motor.

For example, for the muscles of the finger extensor, one motor unit innervates only 10 to 15 muscle fibers [3], which enables a finer gradation of the motor function, for the flexor muscle of the arm (M. biceps brachii) a single motor unit supplies 750 muscle fibers. The “all or nothing principle” applies to all innervated striated muscle fibers, ie in a motor unit either all innervated striated muscle fibers contract simultaneously or all do not [4].

rPMS - Effect on motor nerves

The resting potential of peripheral nerve cells is between -65 to -75 mV, with changes of +10 to +20 mV already causing a depolarization of the nerve cell. Therefore, with an electromagnetic induction (rPMS) of high intensity ("needle impulse"), a potential shift is possible at any time, which consequently ends in a depolarization or an action potential.

This primarily affects only the thick, myelinated and therefore fast-conducting nerve fibers (A alpha / Ø 10 to 20 µm / conduction speed 60 to 120 m/s [5] or class I according to the Lloyd/Hunt classification). These mixed sensorimotor nerves contain no pain afferents, so stimulation is virtually painless [6] .

Basically, thin, unmyelinated pain fibers (type C / Ø 0.5 to 1.5 µm / 0.5 to 2m/s) are not activated. For the same reason, the sacral nerve fibers of the parasympathetic (type C) remain unresponsive. Since the stimulus threshold for skeletal muscles is much higher than for nerve cells, direct muscle stimulation is impossible [7] .

An rPMS-related polarization lowers the membrane potential of the neighboring neurons, so that the set initial impulse jumps like a chain reaction to the motor endplate and the corresponding muscle fibers. The result is a strong muscle contraction depending on the intensity and frequency used. From a frequency of about 20 Hz, a tetanic muscle contraction (continuous contraction) occurs, which could be demonstrated, for example, in an EMG-controlled examination of the lower leg muscles [8] .

An external electromagnetic field acts primarily in the direction of the axon. Field components perpendicular to the axon are negligible [9] .

Since the pelvic floor contains a large number of different striated (skeletal) muscles, a general percentage distribution cannot be determined exactly. For example, the proportion of type I fibers in the pubococcygeus muscle is said to be 70% ([10] . Another study estimates the type II content in the puborectalis muscle at 19% [11] and at the same time emphasizes that the Distribution of the muscle types is completely different depending on the region [12] , even in relation to a single pelvic floor muscle [13] .

This even goes so far that there are differences between the left and right side in stress incontinence, for example in the M. levator ani [14] , [15] . Post-mortem analyzes have shown, for example, that the muscles close to the urethra (periurethral) surprisingly contain only 4% faster fibers. In the case of stress incontinence, the fast fibers in the M. levator ani are also said to be reduced [16] .

In incontinent subjects, the delay between neural stimulus and contraction of slow muscle fibers is more pronounced than in healthy subjects [17] . It appears that the innervation of the pelvic floor muscles is damaged. As a result, the associated muscle fibers atrophy (atrophy).

However, unaffected nerve fibers in the vicinity can force reinnervation and even change their morphology, i.e. convert from originally fast fibers to slow fibers, thus maintaining the functional integrity of the pelvic floor [18]. Muscles therefore have a considerable potential for self-repair - if a corresponding stimulus is present.

With rPMS, the selected frequency alone decides which muscle fiber type is preferentially addressed. The right choice of setting is therefore decisive for the success of the therapy.

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rPMS - effect on proprioception

Proprioceptors (deep sensitivity) are sensors whose task is to constantly provide information about the position and movement of the body. They are contained in muscles and tendons and provide information about the position of the joints, the speed and direction of a change in position and the force used to do so.

Explanation of proprioceptors:
The proprioceptors include muscle spindles, i.e. fibers that run parallel to the muscle fibers and provide information about the length or shortening of the muscles. Their neural transmission (afference) occurs mainly via nerve fibers of class Ib ("myelin-coated"), ie they conduct the information at high speed into the spinal cord, where the information is answered directly with reflexes (reflex arc). These are, for example, motor signals to the muscle with the task of preventing overstretching of the muscle, but also of blocking the antagonistic muscles. However, there is always a transmission (at a lower conduction speed) to the thalamus, which then passes the whole thing on to the cerebral cortex (cortex). The same applies to the Golgi tendon organs.

In addition to their task of coordinating muscle movements, proprioceptors are also responsible for the cortical representation in the somatosensory cortex, ie repeated movements in the same direction characterize and expand this area.

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rPMS - direct stimulation of the proprioceptive sensory nerve pathway

After rPMS generates action potentials on medullary motor nerves (type 1a/b), the medullary afferent fibers of proprioception also react accordingly. Although these only reach as far as the reflex arc, the nerve signal is passed on in the direction of the cortex through (thin) slowly conducting nerve tracts. Since the original signal has already been received, there is a quasi-double transmission of information to the cortex: on the one hand through the contraction of muscle fibers and ligaments caused by the rPMS, on the other hand through the (parallel) direct rPMS stimulation of the proprioceptive, afferent running sensory nerve pathways [19], [20].

rPMS - Representation Center

Cells and cell functions in our body are naturally set to a permanent “save mode” so as not to waste energy and resources unnecessarily. This also affects the so-called coordination of skeletal muscles. During an active muscle contraction - depending on the resistance or the expected effort - not all muscle fibers contract. Only part or even a fraction of the muscle potential is activated.

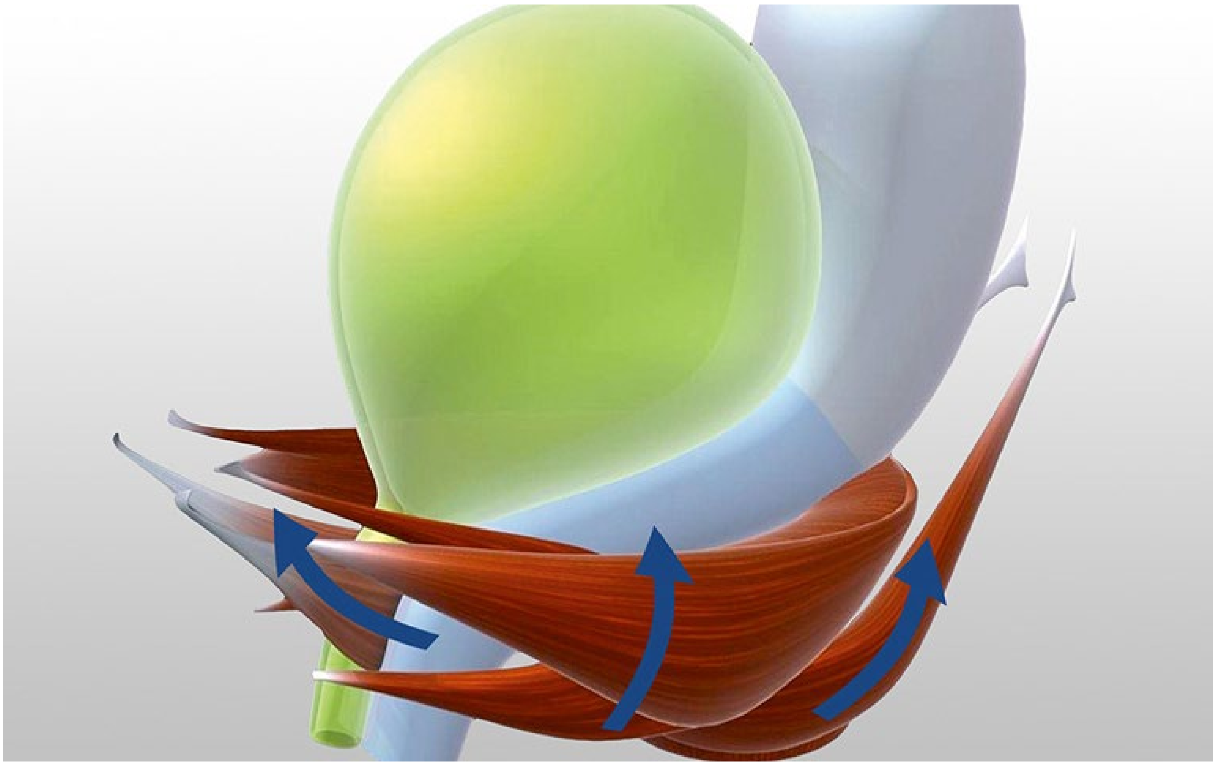
Coordination is understood to mean, among other things, the synergistic interaction between intrinsic (“inner, deep muscles”) and extrinsic (“outer”) muscles.

On the other hand, however, it is also impossible, for example, to cause all the fibers of a muscle to contract at the same time. The maximum value is only about 65 to 70% under normal conditions. Only in extreme situations such as fear of death (or under doping) are 90% of all "existing" muscle fibers addressed [21], [22]. Prerequisites are, of course, existing or undamaged muscle fibers, an adequate supply of muscle fibers by a respective motor unit and ideally a corresponding pre-programming in the motor cortex or representation center.

For example, just lifting an arm shortly beforehand leads to a stabilizing pelvic floor contraction [23]. It is therefore believed that synergistic co-contractions are a natural response pattern to effectively counter sudden increases in abdominal pressure.

Coordination training using rPMS results from the repetition of motor impulses. It makes no difference whether the training refers to a concentric or isometric contraction. If only isolated, isometric tension is trained during conventional pelvic floor training, the muscles can only generate a small part of the maximum possible force. [24].

In contrast, with electrotherapy - and thus also with rPMS - the recruitment order of the muscle fibers is not fixed and is therefore global [25]. When a single pelvic floor muscle is electrically stimulated, there is a tendency for all the other muscles in the composite to contract, ie to respond as a single muscle [26].



Graphic: If a single pelvic floor muscle is electrically stimulated, all the other muscles in the connected unit also contract.

Repeated rPMS training, in which ideally 100% of all muscles of the pelvic floor are at least addressed, strengthens the interconnection of the motor cortex and proves the neuroplasticity of the CNS [27] , [28] , [29] , [30] . The underlying sensorimotor influx corresponds to the lost physiological proprioceptive afferents during active movements and replaces them as it were [31] .

After the end of a stimulation series, which is to be carried out 3 times a week over 6 weeks from a sports-physiological point of view, a later activation of previously unused muscle fibers from the representation center of the cortex is made possible. This means that natural cortical demands on the pelvic floor will be answered by all available muscles of the pelvic floor in the future. However, always with the “limitation” that “trained” buttock muscles (M. glutaei) also react.

During rPMS training, the buttocks and hamstrings are also trained, thereby strengthening the cortical representation for this area. The possible risk of "faulty feedback" in rPMS training can be considered low, since the mechanism of "passive" stimulation of the pelvic floor muscles does not depend on whether the patient is aware of the muscle contractions taking place.

rPMS - muscle growth

Putting aside the fact that passive muscle stimulation cannot fully correspond to a natural movement in the graduated association of different muscles, there is no difference in terms of pure muscle growth. In an in vitro study with human muscle cells obtained by biopsy, the differentiation rate increased by 44% under rPMS compared to only 26% in the untreated control group [32] . The protein PGC-1 alpha also increased as an expression of an increased training adaptation of the muscle. Likewise, mRNA and protein synthesis increased and there was a doubling of acetylcholinesterase, which reflects increased synaptic activity.

Explanation of PGC-1 alpha:
PGC-1 alpha controls the adaptation mechanisms of endurance training and thus has a significant impact on metabolism and muscle function. It increases the endurance of the muscles by, among other things, regulating the formation and breakdown of lactate.

In a companion in vivo animal study in rats, rPMS resulted in accelerated muscle cell differentiation and injury healing, ie accelerated nerve ingrowth and the appearance of acetylcholine receptors, which are necessary for stimulus transmission at the motor endplate.

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summary

With adequate, but often not optimal therapy instructions and good patient adherence, a classic pelvic floor therapy or continence training promises good (to very good) treatment successes. However, the required physical and time commitment with consecutively often lacking therapy adherence often lead to a limited or insufficient therapy success.

Drugs as well as a now unmanageable number of modern surgical techniques cannot convince, especially with regard to the long-term results. Irrespective of this, a large number of those affected do not want to have an operation or are not suitable for a surgical procedure for a variety of reasons.

In contrast, rPMS represents a genuinely effective treatment alternative. With no stressful surgical intervention or the undesirable side effects of drug therapy, rPMS offers a good chance of success without a continuous training discipline that is often perceived as strenuous and annoying.

The application fidelity is supported by the discreet (no undressing necessary) and the hygienic (no insertion of vaginal/rectal probe) implementation in a comfortable sitting position. The perception of the magnetic muscle contraction, which is perceived as "not disturbing", facilitates perception and improves the coordination of the isolated use of the pelvic floor muscles. At the same time, a sustainable optimization of strength and endurance of the pelvic floor is induced.

In addition, the rPMS offers the extraordinary opportunity to help a large number of incontinence sufferers (men and women!), who have closed themselves off to *therapy out of shame or resignation, to improve participation again through effective treatment!*

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