Commentary

Web-based exercise therapy for the treatment of depression

Perspectives from sports science

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Background

Unipolar depression is the world-wide leading cause of disability [1] with an estimated life-time prevalence of 17% [2]. Major depressive disorder (MDD) is commonly treated with antidepressant medication and/or psychotherapy. However, some patients with mild to moderate depressive symptoms prefer additional or alternative therapy approaches such as exercise [3, 4]. Regular exercise ideally results in a clinically relevant improvement of depressive symptoms [4, 5, 6] and an increase in endurance performance that reduces the risk of cardiovascular events, and type 2 diabetes, for which MDD patients are susceptible [7].

Due to extended waiting periods for MDD patients to receive treatment in some countries, e.g., Germany [8], therapeutic strategies that provide a fast, universal access and require limited resources are needed. Web-based therapeutic approaches fulfill these claims and may provide a similar outcome compared to face-to-face interventions [9]. Previous studies have highlighted the potential of web-based interventions to support patients regardless of their location [10, 11]. For example, computerized cognitive behavioral therapy (cCBT) has revealed similar effects compared to face-to-face interventions in psychiatric disorders with moderate effect sizes when provided individually tailored [9]. Of note, these conclusions are based on a comparably low sample size [12] and the success of a cCBT may depend on patient characteristics such as baseline depression [13]. In contrast to cCBT, exercise is cognitively less demanding and capable of promoting health-related effects in a patient cohort that is vulnerable for cardiovascular diseases [7]. In addition, exercise may be attractive to patients who do not respond to psychotropic drugs [14].

This commentary addresses web-based exercise, defined as exercise interventions delivered via email, mobile app or website [15] as a promising therapeutic approach for the treatment of depressive symptoms. I summarize the current research in this area and offer an innovative perspective from the field of sports science on how exercise can be managed in this patient collective. The manuscript concludes with key features for future web-based approaches to further improve the evidence for this approach.

Type, frequency, and intensity of exercise

Schuch et al. [4] concluded that aerobic exercise at moderate intensity and under supervision is most beneficial for MDD patients. Regarding frequency, Blumenthal et al. subjected patients to 90 minutes (3×30 minutes) of weekly endurance exercise [5, 6]. Dunn and colleagues [16] have shown that three to five endurance exercise units are tolerated by MDD patients. However, five sessions did not show a superior effect on depressive symptoms compared to three units. Rethorst and Trivedi [17] recommended both aerobic and strength training with three to five sessions per week of 45–60 minutes. The appropriate type of exercise, however, could also depend on the patient's preferences. Of note, these recommendations apply to patients of normal age [18], and most exercise studies have included subjects aged 18–55 years [5, 16, 19]. However, especially at older ages, the ability to engage in structured, vigorous exercise may decline due to psychological and physical barriers. Therefore, the focus in this age group should be on appropriate and patient-preferred types of exercise (e.g., strength training, endurance training), taking into account barriers, physical abilities, and training status when determining the frequency and intensity of exercise [20, 21].

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Web-based exercise – attitudes, challenges, and evidence

Previous therapy approaches focused on supervised attendance exercise [5, 6, 16] with evidence of large positive effects on depressive symptoms [4]. Patients with mental illness seem to have a positive attitude towards being physically more active. Many complain about a lack of social support though [22]. Thus, regular support and feedback should be provided to engage patients in PA. Patients seem to be open-minded towards web-based interventions and appreciate the autonomy benefits. In contrast, therapists tend to have a more skeptical attitude [14]. In another survey, patients rated web-based therapy helpful but not equivalently effective as face-to-face therapy [23], even though, evidence suggests a comparable potential [9]. Thus, therapists and patients should be educated about the potential of web-based interventions [14], with patients ideally being informed by therapists in person about all treatments applied. Ultimately, a confident therapist can potentially initiate a putative placebo response by increasing patient's treatment expectations to maximize the therapeutic outcome [24].

MDD patients are typically characterized by low levels of physical activity (PA) and a reduced fitness compared to healthy controls [22, 25]. Perceived barriers such as "no time", or "physically unable" to be active [26] and disease-specific obstacles may prevent patients from participating in PA. Lower self-efficacy can lead to a lack of confidence to engage in PA, exacerbated by a lack of social support [22]. This illustrates the challenge to design web-based exercise concepts.

To date, few studies have addressed the reduction of depressive symptoms through web-based exercise. In a recent review, only three studies were included [15]. Two studies could not demonstrate an improvement of depressive symptoms compared to the control condition [19, 27], while one study demonstrated a favorable effect of web-based yoga [28]. Haller et al. [19] demonstrated improvements in self-efficacy, quality of life and performance variables after a mixed endurance/resistance training intervention. Teychenne et al. [27] could demonstrate an initial improvement in self-reported PA in postnatal women, who performed multicomponent home-based exercise for 12 weeks. However, PA was lower after the 12-week training program than in the control group.

Exercise prescription

Web-based concepts aim at i) encouraging a large number of patients to engage in PA, and ii) promote positive health outcomes [10]. Importantly, patients may be at increased risk for overload and injury due to lower levels of PA and fitness [25]. An evidence-based load management in web-based concepts, i.e., to prescribe, monitor and adjust exercise [29], seems thus crucial (Figure 1).

Training load should be prescribed individually tailored due to the heterogeneity in the MDD patient collective as conducted in previous studies with other diseases [30, 31]. When sad feelings, fluctuations in depressive symptoms, or stress occur, patients may be unwilling to exercise [22]. Thus, patients should have the flexibility to conduct the prescribed exercise on a self-chosen time point during a week. In this respect, web-based approaches have an advantage over face-to-face events, as training sessions are not subject to a scheduled date and time and can be completed whenever the patient feels motivated. Exercise schedules should contain achievable target ranges of exercise intensity (e.g., heart rate (HR) 120–140 bpm). In case of reduced energy [1], patients are able to adapt their individual physical and psychological condition to the exercise intensity on a given day [32]. This is in line with MDD exercise guidelines that recommend exercising within a range of 50 to 85% of maximum HR [17]. Alternative training options could be provided via an application when the regular training is difficult to perform for patients [15].

Besides monitoring patients with objective tools such as HR, training load should also be assessed with the help of subjective feedback. Simple questionnaires, such as the Borg-scale, are appropriate for measuring perceived exercise intensity in clinical populations [33]. If patients report scores in the maximum fatigue range, this should be taken as a sign to reduce the training load [11, 19]. Data on depressive symptoms can also be included in training planning, as depressive symptoms may affect the ability to exercise.

To determine appropriate and effective training zones, physiological exercise testing before the start of training is considered the gold standard, also from a health point of view. If a health assessment has already been done, modern smartwatches often have easy-to-use endurance performance diagnostics that allow for training zone determination. This option of a "simplified performance diagnostics" could be preferred, particularly in web-based programs to replace elaborate physiological exercise testing. However, the results of such a simplified performance diagnostics should be reviewed once by a sports scientist.

To avoid overload, poorly trained individuals may begin their program with two sessions per week, although this does not strictly follow the recommendations for MDD [17]. However, it is important to gradually increase the training load, as higher training load can lead to stronger antidepressant effects [4, 16]. Progression can be achieved by setting a percentage by which the training load is increased after a certain period of time (e.g., 5–10%). Further tools such as the "acute-to-chronic workload ratio (ACWR)" may also prevent overload and injury [34]. Briefly, the

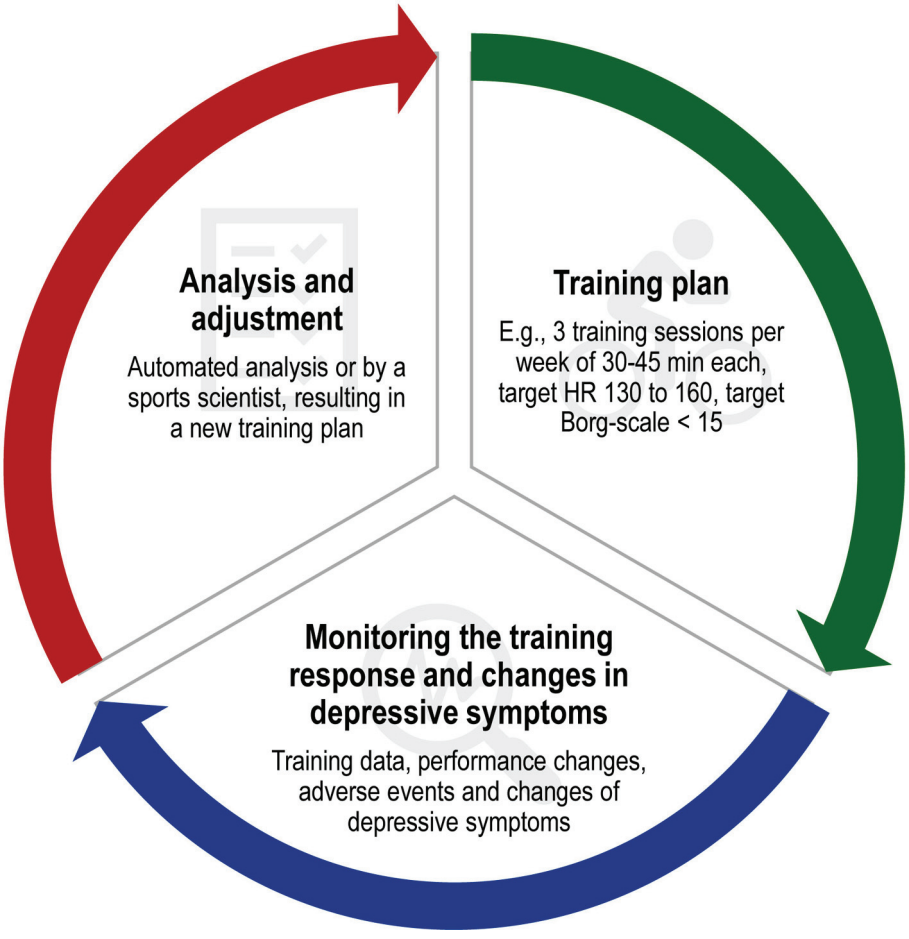

Figure 1. Load Management in MDD patients. A training Plan includes different training loads that leads to an individual training response (measured by e.g., heart rate and/or subjective perceived exertion. These data as well as changes in depressive symptoms may lead to an adjustment in training load.

chronic load is related to the acute load. For instance, a patient exercises 150 minutes per week for 4 weeks. If we consider increasing this load to 180 minutes in week 5, this will result in an ACWR of 1.2 (180/150=1.2). Scores of >1.5 are associated with an increased risk of injury. Consequently, such tools can help to safely increase training load over time. It should be noted, however, that this concept was validated primarily in the athlete collective.

It becomes apparent that many variables can be incorporated into training load planning. Consequently, it is particularly efficient to collect this data fully automatically via an application, develop algorithms, e.g., using models like the ACWR, that analyze training data and suggest new training plans based on these data. At best, these then only need to be reviewed by a therapist.

Further key features of web-based concepts and open questions to be addressed

Computerization to automatically develop exercise schedules may help in reaching a high number of patients while being cost-effective. However, complete computerization without therapists may compromise features that contribute to program adherence and thus high treatment efficacy [35] as outlined in Figure 2.

Support, motivation and feedback about what patients have accomplished in PA from a therapist seem necessary to maximize adherence, reduce dropouts and promote health-related benefits [4, 17, 35, 36, 37]. Because there is a tendency towards non-usage of web-based applications [38], a familiarization with the therapist may be important to reach sufficient adherence [35, 36]. "Push factors", such as new content, and text messages may further promote PA [10] in approaches that should ideally be personalized, e.g., greeting the participants with their name [35]. Further behavioral components such as goal-setting and self-monitoring may be helpful to reach objectives in the long run [10, 39]. It is also beneficial if the application has a modern design [40]. One of the forthcoming challenges is to find a balance between elaborate therapist support and cost-effective computerization. While additional antidepressant effects may be achieved with close therapist support (i.e., therapist contact as part of the intervention e.g., via telephone) before or, at best, also during the intervention, failure to provide human support and feedback may reduce

Figure 2. Contributing factors to good adherence and, thus, good efficacy in the MDD patient collective.

costs but can lead to a higher dropout rate and uncertainty about the true effects [35, 36].

Despite the great potential, overall effects of web-based exercise therapy on depressive symptoms are not yet clear. Compared to attendance exercise therapy [4] mean effects of web-based exercise could not yet be calculated in a meta-analysis. Therefore, further randomized-controlled trials are needed. In addition, the effects of different exercise mode (e.g., resistance training, endurance training, relaxation) need to be investigated in future studies [15, 41].

A future study could compare three groups, i.e., a fully computerized web-based intervention, an elaborate web-based intervention with scientific support, and a control condition to allow a comparison between cost-saving computerization and elaborate support. Studies should have a duration of at least 10 weeks [17]. A longer duration could be chosen if poorly trained patients are included and researchers wish to apply a mild progression of training load. Since long-term effects of web-based exercise therapy are unknown, it is strongly recommended to ascertain follow-up data. A lack of follow-up leads to uncertainty whether effects remain stable over time, even if a meta-analysis calculated small to moderate persistent effects on depressive symptoms after 12 months of follow-up [42]. To verify whether web-based approaches are well-accepted, dropout rates in the intervention groups, total training units conducted, weekly PA time, and the ratio of conducted to recommended training sessions should be collected [43].

In summary, there are few meaningful studies in the area of web-based exercise for patients with MDD to date. Useful features, such as therapist support or an individualized treatment approach can be adopted from previous web-based approaches as well as from sports science, which should be applied in up-coming studies.

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