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Running head: ICBT FOR PERFECTIONISM

A randomised controlled trial of unguided internet cognitive-behavioural treatment for perfectionism in individuals who engage in regular exercise

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Abstract

Objective: Clinical perfectionism has been found to be a risk and maintaining factor in eating disorders, compulsive exercise and athlete burnout. This study investigated whether an unguided internet cognitive behavioural treatment (ICBT) for perfectionism would reduce eating disorder pathology, compulsive exercise, and burnout in individuals who engage in regular exercise.

Method: Participants were randomly allocated to intervention (n = 38) or waitlist control (n = 29). A generalised linear mixed model (GLMM) analysis was conducted pre and post treatment. A follow up analysis was conducted with the intervention group at 3 and 6 months.

Results: The intervention group experienced a significant reduction in perfectionism (FMPS-CM:F[1,117] = 17.53, p = <.001, Cohen's d = .82), eating disorder symptomology (EDE-Q:F[1,55] = 7.27, p = .009, Cohen's d = .53) and compulsive exercise (CET:F[1,116] = 10.33, p < .001, Cohen's d = .63). These changes attained post-treatment were maintained within the intervention group at 3 month (FMPS-CM(t[1,100] = 3.67, p < .001, Cohen's d = .85)(EDE-Q(t[1,50] = 2.20, p=.03, Cohen's d = 1.26) and 6 month follow-up (FMPS(t[1,100] = 2.74, p = 007, Cohen's d = .70) (EDE-Q(t[1,50] = 2.18, p = .03, Cohen's d = 1.26).

Discussion: The results indicate unguided ICBT for perfectionism can have a significant impact on perfectionism, compulsive exercise and eating disorder symptomatology.

Keywords: eating disorders, unguided, self-help, internet, cognitive-behaviour therapy, perfectionism.

Highlights

- 8-week unguided cognitive behavioural treatment for perfectionism was administered
- There was a significant decrease in perfectionism and eating disorder symptoms
- Treatment also resulted in reductions in compulsive exercise
- Small effect size reductions were maintained at 6 month follow-up
- ICBT for perfectionism holds promise for reducing eating disorders

A randomised controlled trial of unguided internet cognitive-behavioural treatment for perfectionism in individuals who engage in regular exercise

1 Compulsive exercise is associated with an extreme urge to exercise and difficulty 2 stopping exercise despite adverse effects including injury (Taranis, Touyz, & Meyer, 2011). 3 A strong association has been found between compulsive exercise and eating disorder (ED) symptomatology (Egan et al., 2017). ED symptomatology and compulsive exercise is also 4 strongly related to perfectionism (Egan et al., 2017; Egan, Wade, & Shafran, 2011; Limburg, 5 Hagger, Watson, & Egan, 2017). Another variable related to compulsive exercise is burnout, 6 7 where concern over mistakes on the Frost Multidimensional Perfectionism Scale (FMPS; Frost, Marten, Lahart, & Rosenblate, 1990) has been found to predict burnout in athletes (Hill 8 & Curran, 2016). Despite the relevance of perfectionism to compulsive exercise and burnout 9 10 in athletes, surprisingly little research has examined whether treatment for perfectionism may impact on these conditions in addition to ED symptomatology. 11

Given the link between perfectionism and ED symptomatology, compulsive exercise, 12 and burnout, the aim was to examine the efficacy of cognitive-behavioral therapy (CBT) for 13 perfectionism in reducing these conditions in individuals who engage in regular exercise. A 14 15 meta-analysis of CBT for perfectionism treatment found large effect size reductions in perfectionism and medium effect size reductions in anxiety and depression (Llovd, Schmidt, 16 Kohndoker, & Tchanturia, 2015). CBT for perfectionism has been found to reduce ED 17 symptomology (Handley, Egan, Kane, & Rees, 2015; Steele & Wade, 2008; Wilksch, 18 Durbridge, & Wade 2008), and delivered via the internet (ICBT) to result in significant large 19 effect size reductions in perfectionism, anxiety, and depression (Egan, van Noort et al., 2014; 20 21 Rozental et al., 2017; Shafran et al., 2017). In the current study, it was hypothesized that ICBT for perfectionism would reduce perfectionism, ED symptomatology, compulsive 22 exercise and burnout post-treatment compared to the waitlist control group, and these gains 23

24 would be maintained at three- and six-month follow-up.

25

Method

26 **Participants**

27	Participants were 67 adults, 41 female (M age = 37; SD = 12) who met the inclusion
28	criteria of elevated perfectionism based on previous trials (Egan, van Noort et al., 2014) of a
29	FMPS-CM (Frost et al., 1990) score of 24.7 or greater. See Page 1 of Supporting information
30	for power analysis. We defined 'regular exercise' as sport or exercise participation 2+ times
31	per week, per previous research (Egan et al., 2017). Participants engaged in exercise an
32	average of 5 days ($SD = 1.30$) and 11.5 hours ($SD = 7.9$) per week. This is comparable to
33	Muscat and Long (2008; $M = 10.6$, $SD = 7.1$) who investigated EDs in athletes, and are
34	higher than the general population where the average for adults is 3.5 hours per week
35	(Australian Bureau of Statistics, 2013).
36	For exclusion criteria, see Page 1 of Supporting Information. Recruitment and
37	attrition can be seen in Figure 1.
38	[Insert Figure 1 here]
39	Measures
40	The full detail of the Measures is included on Page 4 and 5 of the Supporting
41	Information. The Mini International Neuropsychiatric Interview-Screen (Sheehan et al.,

42 1998) was administered by phone to screen for current psychological disorders. The *Frost*

43 Multidimensional Perfectionism Scale 'concern over mistakes' subscale (FMPS-CM; Frost et

44 al., 1990) was used as the screening tool to indicate elevated perfectionism and as the primary

45 outcome measure. The FMPS-CM was chosen to allow comparison to previous ICBT for

- 46 perfectionism trials which also used the CM subscale as the primary outcome variable (Egan,
- 47 van Noort et al., 2014; Rozental et al., 2017). The *Clinical Perfectionism Questionnaire*

48 (CPQ; Fairburn, Shafran, & Cooper, 2003), Eating Disorder Examination-Questionnaire

49 global scale (EDE-Q; Fairburn & Beglin, 2008), Compulsive Exercise Test (CET; Taranis et

al., 2011), and Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) were used.

- 51 Further detailed descriptions of outcome measures can be found Page 4 Supporting
- 52 Information.

53 **Procedure**

Participants were recruited in Australia through sporting club newsletter
advertisements, social networking (Facebook), coach referrals, and distributing information at
Triathlon races and to sports physiotherapists. The sample consisted of 67 individuals, 75
were initially recruited and consented but 8 participants were excluded due to ineligibility
with perfectionism criteria (4), age (2) and clinical diagnoses (2) (Figure 1). Further
information regarding screening and allocation can be found on Page 2 of Supporting
information.

Participants were randomised to *ICBT for perfectionism* (n = 38), where they received a weekly email for eight weeks with relevant Overcoming Perfectionism (Shafran, Egan, & Wade, 2010) book chapters and homework activities or *waitlist control* (WL) (n = 29), an eight-week waitlist with no contact from the investigator. Measures were completed online at baseline, post-treatment/waitlist, and 3 and 6 months post-treatment (for the intervention group only). More detail about recruitment, randomization, and the intervention is on Page 2 and 3 of the Supporting Information.

68

Results

69 **Descriptive statistics**

70 Sixty-seven participants were included (Figure 1). Mean scores on outcome measures71 can be seen in Table 1.

72

[Insert Table 1 here]

Baseline scores on the CPQ suggest clinical perfectionism (M = 30.24, SD = .95) was 73 comparable to previous perfectionism intervention studies (M = 29.44, SD = 4.60; Egan, van 74 75 Noort et al., 2014: M = 32.10, SD = 1.17; Handley et al., 2015). The current sample also had lower FMPS-CM (M = 29.11, SD = .96) scores than in previous trials (M = 33.72, SD = 5.31; 76 Egan et al., 2014: M = 33.14, SD = 1.32; Handley et al., 2015). Mean baseline scores on the 77 EDE-Q (M = 2.18, SD = .30) suggest participants were not in a clinical ED range (M = 2.30; 78 Mond et al., 2004), but higher than samples of athletes in another study (M = 1.22, SD =79 80 1.03; Darcy, Hardy, Lock, Hill, & Pebbles, 2013). Attrition was reasonable for the intervention group at 3 month follow-up (26%), but high at 6 months (55%). 81

82 Effect of unguided ICBT for perfectionism at post-treatment

A explanation of the GLMM analysis can be found on Page 6 of the Supplementary 83 information. The results of generalised linear mixed model (GLMM) indicated Significant 84 Group x Time (between-group) interaction effects for perfectionism (FMPS-CM: F[1,117] =85 17.53, p = <.001, Cohen's d = .82), (CPQ: F[1,116] = 12.50, p = .001, Cohen's d = .69) and 86 compulsive exercise (CET: F[1,116] = 10.33, p < .001, Cohen's d = .63). Errors in the 87 administration of the EDE-Q invalidated a proportion of participant's responses (intervention 88 n=20, control group n=16). Thus, the EDE-Q analysis conducted with 31 participants found 89 a significant group \times time interaction effect for ED symptomatology (EDE-O: F [1,55] = 90 7.27, p = .009, Cohen's d = .53). A series mean was calculated for 3 items for 28 participants 91 in the ABQ analysis due to administration error. The ABQ did not yield a significant 92 93 interaction effect (F [1,117] = .86, p = .36, Cohen's d= .18).

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96 Effect of unguided ICBT for perfectionism at follow-up

97 Significant pre-post changes prompted further investigation into evidence of treatment
98 (within-group) effects maintained at three- and six-month follow-up. The investigation was
99 conducted on the intervention group only due to no control group at follow up.

Follow-up analysis using a Group*Time fixed effect pairwise contrast on the FMPS-100 CM indicated large, statistically significant treatment effects were maintained at three month 101 FMPS-CM (t[1.100] = 3.67, p <. 001, Cohen's d = .85) and six-month follow-up (t[1.100] = 102 2.74, p = 007, Cohen's d = .70) (Cohen, 1988). A large, statistically significant pairwise 103 comparison between pre-treatment and three-month follow-up mean scores on the CPQ was 104 also found (t[1,100] = 5.73, p < .001, Cohen's d = 1.14). The statistically significant and 105 medium intervention effects found on the CET were maintained at three-month follow-up 106 107 (t[1,94] = 5.00, p < .001, Cohen's d = .64) and at six months (t[1,94] = 3.13, p = .002, Cohen's d = .64).41). Follow-up analysis on the EDE-Q global score, indicated statistically significant and 108 large intervention effects were maintained at three months (t[1,50] = 2.20, p=.03, Cohen's d109 =1.26) and six months (t[1,50] = 2.18, p = .03, Cohen's d = 1.26). 110

111 A comparison was conducted in the intervention group to examine if there were any 112 further significant gains in outcome between post-treatment and three and six-month follow-113 up. From post-treatment to six months, there was a small, statistically significant difference 114 that represented continued improvement on the CPQ (t[1,100]=5.09, p <.001, Cohen's d = 115 .23).

116 To test for slower-term treatment effects on the ABQ, as initial models tested time 117 represented by pre-treatment and post-treatment only, pre-to-follow-up and post-to-follow-up 118 comparisons were conducted in the intervention group. Follow-up analysis on the ABQ indicated no significant effect at three (*t*[1,90] = 1.06, p=.29) and six months (*t*[1,90] = 1.80,
p =.08).

Reliable and clinically significant change was investigated for the main variables of 121 interest, perfectionism and ED symptomatology. Reliable change pre to post treatment can be 122 seen in Table S2. There was no difference between the intervention and control group on the 123 ABQ (γ^2 [2] = 2.05, p = .359), CPQ (γ^2 [2] = 3.95, p = .139), CET (γ^2 [2] = 2.07, p = .355), or 124 EDE-Q (χ^2 [2] = 4.54, p = .103). However on FMPS CM, the intervention group had 125 significantly greater reliable change than control (65.5% versus 8%; γ^2 [2] = 20.44, p < .001). 126 Clinical significance was calculated (see Supplementary materials for cut-offs). For the EDE-127 Q, the percentage of participants showing reliable and clinically significant pre-post 128 improvement was significantly greater in the intervention than control group (47.1% versus 129 8.3%; $p_{\text{Fisher's Exact Test}} = .032$). The same was true for FMPS CM (27.6% versus 0%; $p_{\text{Fisher's}}$ 130 $E_{\text{Exact Test}} = .004$), however for the CPQ there was no significant difference in reliable and 131 clinically significant change between intervention and control group (10.3% versus 0%; p 132 Fisher's Exact Test = .147) (see Table S3). 133

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Discussion

The results suggest that unguided ICBT for perfectionism results in significant 135 decreases in perfectionism, ED symptomology, and compulsive exercise in individuals who 136 engage in regular exercise. Treatment changes were maintained by the intervention group at 137 up to six-month follow-up, although there was significant attrition (55% at six-month follow-138 up). The findings of a significant reduction in perfectionism are consistent with previous 139 140 research, although our effect sizes were lower compared to previous studies (Egan, van Noort et al., 2014; Rozental et al., 2017; Shafran et al., 2017). This difference may be due to 141 previous trials including participants with psychological disorders (Egan, van Noort et al., 142

143 2014) while we excluded those with psychological disorders.

Significant reductions in ED symptomatology was found in support of previous
research (Handley et al., 2015; Steele & Wade, 2008; Wilksch et al., 2008). This is the first
study however to demonstrate significant effects on ED symptomatology for ICBT. The
findings contrast with Egan, van Noort et al. (2014) who found no significant effects of
unguided ICBT for perfectionism on ED symptomatology. This is likely explained by higher
global EDE-Q scores in this study which were only slightly below a clinical range (Mond et
al., 2004).

The significant reduction in compulsive exercise is consistent with previous literature associating clinical perfectionism and compulsive exercise (Egan et al., 2017). We found no reduction in athlete burnout however, which is inconsistent with research indicating an association between perfectionism and burnout in athletes (Hill & Curran, 2016). Perfectionism is only one of many factors that contribute to burnout and future research should investigate other relevant variables.

There were several limitations. We did not collect data on treatment completion; this 157 is important for future research, as number of treatment sessions completed has been shown 158 to be a moderator of treatment response (Shafran et al., 2017). There was substantial attrition, 159 however, this rate is similar to many unguided ICBT studies (Andersson, 2016) and ICBT for 160 perfectionism (Egan, van Noort et al., 2014; Rozental et al., 2017; Shafran et al., 2017). In 161 our study we defined attrition in line with Eysenbach's (2005) distinction of 'non-usage 162 dropout attrition.' Future research with ICBT for perfectionism in individuals who engage in 163 164 regular exercise should examine attrition in more detail by delivery of the treatment given evidence not surprisingly that degree of modules completed predicts treatment outcome (e.g., 165 Shafran et al., 2017). Future research should seek to examine if attrition can be improved by 166

increased structure and guidance in the program, for example feedback on work submitted
being provided by a therapist, as these features have been shown to improve attrition in ICBT
(Andersson, 2016).

170 Excluding participants with a psychological disorder may also have limited the external validity of the results as clinical perfectionism often presents as comorbid with 171 psychological disorders. The study was a first attempt to examine efficacy of ICBT for 172 perfectionism in targeting ED symptoms and compulsive exercise in individuals who engage 173 in regular exercise, and was small in size. Future research should replicate the findings on 174 175 further samples to ensure generalizability. Finally, while we found that reductions in eating disorder symptoms and perfectionism on the FMPS CM were clinically significant, the 176 changes on the CPQ were not clinically significant, and future research is required to 177 investigate this. 178

In summary, unguided ICBT for perfectionism was effective in reducing
perfectionism, ED symptoms and compulsive exercise in individuals who engage in regular
exercise. It remains a question for future research whether ICBT for perfectionism can
prevent EDs in individuals who engage in regular exercise.

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Figure 1. CONSORT flow diagram of participant attrition during stages of the randomised control trial

Table 1

Outcome Measure	Intervention				Waitlist control		α
	Pre	Post	Three-month	Six-month	Pre	Post	_
	(<i>n</i> = 38)	(<i>n</i> = 29)	follow up	follow up	(<i>n</i> = 29)	(<i>n</i> = 26)	
			(<i>n</i> = 20)	(<i>n</i> = 17)			
FMPS-CM	29.11 (0.96)	22.08 (1.21)	24.61 (1.23)	25.53 (1.23)	30.45 (0.95)	30.35 (0.92)	0.88
CPQ	30.24 (0.95)	24.87 (0.98)	25.39 (0.92)	24.94 (1.02)	31.68 (0.78)	30.77 (0.86)	0.80
CET	68.47 (2.84)	55.53 (2.71)	57.23 (3.16)	59.65(3.95)	63.61 (3.10)	62.00 (3.09)	0.87
EDE-Q	2.18 (0.30)	0.96 (0.19)	1.64 (0.33)	1.45 (0.37)	2.24 (0.37)	2.09 (0.34)	0.95
ABQ	2.70 (0.09)	2.65 (0.11)	2.57 (0.14)	2.28 (0.23)	2.65 (0.11)	2.50 (0.10)	0.88

Mean Scores and Standard Deviations of Outcome Measures by Group

Note. Pre = Pre-Treatment, Post = Post-Treatment, a = internal consistency at pre-treatment. FMPS-CM = First Multidimensional Perfectionism Scale Concern over mistakes subscale, CPQ = Clinical Perfectionism Questionnaire, CET = Compulsive Exercise Test, EDE-Q = Eating Disorder Examination Questionnaire, ABQ = Athlete Burnout Questionnaire.

Supporting Information

Valentine et al. A randomised controlled trial of unguided internet cognitive-

behavioural treatment for perfectionism in individuals who engage in regular exercise

Method

Participants

Power analysis was conducted *a priori* with a two-tailed alpha of 0.05, four assessment points, pre-post correlation for the primary outcome measure of 0.61, and an expected attrition rate of 50%, based on previous ICBT for perfectionism trials (Egan, van Noort et al., 2014; Rozental et al., 2017; Shafran et al., 2017). This resulted in 20 participants per group (40 in total) to detect a large effect size (Cohen's d = 0.80) between groups.

The definition of 'regular exercise' we used of sport or exercise participation 2+ times per week is lower than studies which have investigated EDs in competitive athletes (Martinsen & Sundgot-Borgen, 2013). However, our criterion is in accordance with literature reporting amount of exercise is not an essential aspect of compulsive exercise (Adkins & Keel, 2004). The sample participated in a range of sports including running, triathlon, cycling, rowing, hockey and cross fit. The most common sports engaged in were triathlon (53%), running (including marathon and ultra running) (21%), cycling (10%) and athletics (9%).

An exclusion criterion was a psychological diagnosis. This determined that the sample was a pure, 'non-clinical' sample, so that the group was more homogenous and the results would not be affected by a portion of the sample meeting criteria for disorders. Participants were also required to refrain from entering psychological treatment or initiating psychiatric medication during treatment. Those already using psychiatric medication were asked to ensure a stable dose for at least one month prior to study participation. Children (age < 18 years) were excluded from participating.

Procedure

Interested participants contacted the researchers who performed screening over the telephone. Participants were volunteers and were not given remuneration for participation.

Using Graphpad software (<u>http://graphpad.com/quickcalcs/randomize1.cfm</u>) eligible participants were randomly allocated to conditions. The program ensured the investigator was blind to the next allocation, however the first and second authors (EV, KB) used the software, so a third party unconnected to the study was not used to allocate participants.

Intervention

The intervention was developed from 'Overcoming Perfectionism" by Shafran et al. (2010). The treatment - a CBT-based program which examines unhelpful thinking styles and behaviours associated with clinical perfectionism - has been detailed elsewhere (Egan, Wade, Shafran, & Antony, 2014) and is the same protocol examined in another unguided ICBT for perfectionism trial (Egan, van Noort, et al., 2014) (see Table S1). All material was self-directed and completely unguided by a therapist as participants could complete all activities and reading at their own pace. Participants were not instructed to complete one module before starting the next. The modules were delivered on the same day of each week starting from the day eligibility was met. The treatment included text to be read as well and homework (e.g., self-monitoring, behavioural experiments) between sessions, however participants were not required to submit any homework to the researcher. The participants did not receive any reminders if they did not access the treatment materials but were sent reminder emails to complete post-treatment measures. Attrition was defined according to Eysenbach (2005) as 'non-usage dropout attrition', as opposed to 'non-usage attrition' (i.e.,

not accessing the treatment materials); due to the delivery of the treatment via email this data was not available.

Table S1.

Session content for unguided internet cognitive behaviour therapy for perfectionism

Session Number	Session Content
Session 1	Individualized formulation of
	perfectionism and enhancing motivation
	to change perfectionism
Session 2	Self-monitoring and psycho-education
Session 3	Surveys and behavioral experiments
Session 4	Dichotomous thinking; challenging via
	behavioral experiments and continuums
Session 5	Challenging cognitive biases
Session 6	Procrastination, time management and
	pleasant events
Session 7	Self criticism and self compassion
Session 8	Self evaluation and relapse prevention

Measures

The Mini International Neuropsychiatric Interview-Screen (Sheehan et al., 1998) version 5.0 was administered by phone to assess the current symptoms of Diagnostic and Statistical Manual 5 (DSM-5; American Psychiatric Association, 2013) psychological disorders. It has acceptable validity and excellent test-retest reliability (Sheehan et al., 1998).

The Frost Multidimensional Perfectionism Scale 'concern over mistakes' subscale (FMPS-CM; Frost et al., 1990) consists of 9 items used to assess perfectionism. This subscale was used as the screening tool to indicate elevated perfectionism and as the primary outcome measure. The FMPS-CM was chosen as the primary outcome measure to allow comparison to previous ICBT for perfectionism trials which also used the CM subscale as the primary outcome variable (Egan, van Noort et al., 2014; Rozental et al., 2017; Shafran et al., 2017). The FMPS-CM has high construct validity, and acceptable test-retest reliability (Frost et al., 1990). An example of an item is "If I fail at work/school, I am a failure as a person"

The Clinical Perfectionism Questionnaire (CPQ; Fairburn et al., 2003) is a 12-item self-report measure which was used to assess clinical perfectionism. An example of an item is "Over the past month, have you tended to focus on what you <u>have</u> achieved, rather than on what you have not achieved?". The CPQ has been demonstrated to have good validity, internal consistency, and construct validity in both an eating disorder and community sample (Egan et al., 2016).

The Eating Disorders Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 2008) is a 28 item self-report measure of eating disorder pathology over the past 28 days. The EDE-Q consists of four subscales; Restraint (e.g., "Have you <u>tried</u> to follow definite rules regarding your eating in order to influence your shape or weight; for example, a calorie limit, a set amount of food, or rules about what or when you should eat?"); Eating Concern (e.g., "Have you <u>tried</u> to avoid eating any foods which you like in order to influence your shape or

weight?"); Weight concern (e.g., "Have you had a strong desire to lose weight?") and Shape concern (e.g., "Have you definitely wanted you stomach to be flat?"). A global score which is a sum of the four subscales (eating concern, restraint, shape concern and weight concern) was calculated. The EDE-Q has demonstrated excellent test-retest reliability (r = .81 to .94; Luce & Crowther, 1999).

The Compulsive Exercise Test (CET; Taranis et al., 2011) is a 24-item questionnaire which consists of five subscales; Avoidance and rule-driven behaviour (e.g., 'I feel guilty if I miss an exercise session'); Weight control exercise (e.g. 'I exercise to burn calories and lose weight'); Mood improvement (e.g. 'I feel less anxious after I exercise'); Lack of exercise enjoyment (e.g. I find exercise a chore) and Exercise rigidity (e.g. 'I follow a set routine for my exercise'). Plateau and colleagues (2014) suggested using a 15 item, 3-factor structure for the CET when assessing and comparing athletes, which was utilised in this analysis. Using this reduced item CET as suggested by previous research (Plateau et al., 2014), the CET total had a strong positive correlation with the EDE-Q total ($r(685) \ge .47$, p < .01), indicating convergent validity.

The Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) is a 15 item selfreport questionnaire which was used to assess athlete burnout and consists of three 5-item subscales; reduced sense of accomplishment (e.g., "It seems that no matter what I do, I don't perform as well as I should"); devaluation (e.g., "I have negative feelings towards sport"); and emotional/physical exhaustion (e.g., "I am exhausted by the mental and physical demands of my sport"). The global score was utilised as previous research has found a positive association with global score and perfectionistic concerns (Jowett et al., 2016). The global ABQ score has acceptable convergent and divergent validity (Cresswell & Eklund, 2006).

Statistical Analyses

In GLMM it is assumed that data are missing at random, and a non-significant effect on Little MCAR's test supported this assumption, $\chi^2(2) = 3.47$, p = 1.00. The participant and treatment groups were labelled random effects; the Group, Time and Group × Time interaction were labelled as fixed effects. Violations of sphericity were accommodated by changing the covariance matrix from the default of compound symmetry to autoregressive. Full maximum likelihood estimation was used. The major advantage of this estimation procedure is that it uses all the data present at each assessment point (four data points), thereby reducing sampling bias and the need to replace missing data.

Results

Reliable change and clinical significance

Reliable change was calculated for all measures following the procedure described in Jacobson and Truax (1991), and the results can be seen in Table S2. Reliable change can be interpreted as the degree to which the person changes on the outcome variable divided by the standard error of difference between the pretest and posttest scores (Jacobson & Truax, 1991). When the absolute value of the RC score is greater than 1.96 (Wise, 2004, has argued that this value can be reduced in some situations), it is likely that the posttest score is reflecting a *real* change – a *reliable* change - rather than the fluctuations of an imprecise measuring instrument.

Table S2.

Reliable change analysis across four time points (pre, post, 3 and 6 months)

		Waitlist control		
	Pre-post reliable Pre-3 months Pre-6 months		Pre-post reliable	
	change	reliable change	reliable change	change
FMPS-	19/29 improved	9/20 improved	10/17 improved	2/25 improved
CM	8/29 no change	11/20 no change	6/17 no change	22/25 no change
	2/29 deteriorated	0/20 deteriorated	1/17 deteriorated	1/25 deteriorated
CPQ	9/29 improved	6/20 improved	6/17 improved	3/25 improved
	19/29 no change	14/20 no change	11/17 no change	22/25 no change
	1/29 deteriorated	0/20 deteriorated	0/17 deteriorated	0/25 deteriorated
CET	8/29 improved	4/21 improved	2/10 improved	4/25 improved
	21/29 no change	17/21 no change	8/10 no change	20/25 no change
	0/29 deteriorated	0/21 deteriorated	0/10 deteriorated	1/25 deteriorated
EDE-Q	11/17 improved	2/13 improved	4/7 improved	4/12 improved
	6/17 no change	10/13 no change	2/7 no change	6/12 no change
	0/17 deteriorated		1/7 deteriorated	2/12 deteriorated
		0/13 deteriorated		
ABQ	7/29 improved	4/20 improved	3/7 improved	5/25 improved
	20/29 no change	13/20 no change	3/7 no change	20/25 no change
	2/29 deteriorated	3/20 deteriorated	1/7 deteriorated	0/25 deteriorated

Clinical significance was calculated using the clinical cut off of <2.30 for the EDE-Q (Mond et al., 2004), and Jacobson and Truax (1991) criteria of two standard deviations from the norm for the CPQ (Fairburn et al., 2003) and FMPS CM (Frost et al., 1990).

Table S3.

Clinical significance (CS) analysis across three time points (post, 3 and 6 months) for

perfectionism and eating disorder symptomatology

Intervention			Waitlist control	
Post-test	3-months	6-months	Post-test	
E	Post-test	Post-test 3-months	InterventionPost-test3-months6-months	

FMPS-	8/29 CS	3/20 CS	3/17 CS	0/25 CS
CM	improvement	improvement	improvement	improvement
	21/29 no CS	17/20 no CS	14/17 no CS	25/25 no CS
	change	change	change	change
CPQ	3/29 CS	2/20 CS	1/17 CS	0/25 CS
	improvement	improvement	improvement	improvement
	26/29 no CS	18/20 no CS	16/17 no CS	22/25 no CS
	change	change	change	change
EDE-Q	8/17 CS	0/13 CS	2/7 CS	1/12 CS
	improvement	improvement	improvement	improvement
	9/17 no CS change	13/13 no CS	5/7 no CS change	11/12 no CS
		change		change

Note: CS = Clinically significant; FMPS-CM = Frost Multidimensional Perfectionism Scale -

Concern over Mistakes subscale (Frost et al., 1990); CPQ = Clinical Perfectionism

Questionnaire (Fairburn et al., 2003); EDE-Q - Eating Disorders Examination -

Questionnaire (Fairburn & Beglin, 1994).

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