Journal of Affective Disorders 152-154 (2014) 113–121

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research report

Internet-based versus face-to-face cognitive-behavioral intervention for depression: A randomized controlled non-inferiority trial ☆

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ARTICLE INFO

Article history:
Received 12 April 2013
Received in revised form
20 June 2013
Accepted 21 June 2013
Available online 23 July 2013

Keywords:
Depression
Internet
Face-to-face
CBT

ABSTRACT

Background and aims: In the past decade, a large body of research has demonstrated that internet-based interventions can have beneficial effects on depression. However, only a few clinical trials have compared internet-based depression therapy with an equivalent face-to-face treatment. The primary aim of this study was to compare treatment outcomes of an internet-based intervention with a face-to-face intervention for depression in a randomized non-inferiority trial.

Method: A total of 62 participants suffering from depression were randomly assigned to the therapist-supported internet-based intervention group ($n=32$) and to the face-to-face intervention ($n=30$). The 8 week interventions were based on cognitive-behavioral therapy principles. Patients in both groups received the same treatment modules in the same chronological order and time-frame. Primary outcome measure was the Beck Depression Inventory-II (BDI-II); secondary outcome variables were suicidal ideation, anxiety, hopelessness and automatic thoughts.

Results: The intention-to-treat analysis yielded no significant between-group difference (online vs. face-to-face group) for any of the pre- to post-treatment measurements. At post-treatment both treatment conditions revealed significant symptom changes compared to before the intervention. Within group effect sizes for depression in the online group ($d=1.27$) and the face–to-face group ($d=1.37$) can be considered large. At 3-month follow-up, results in the online group remained stable. In contrast to this, participants in the face-to-face group showed significantly worsened depressive symptoms three months after termination of treatment ($t=-2.05$, df$=19$, $p<.05$).

Limitations: Due to the small sample size, it will be important to evaluate these outcomes in adequately-powered trials.

Conclusions: This study shows that an internet-based intervention for depression is equally beneficial to regular face-to-face therapy. However, more long term efficacy, indicated by continued symptom reduction three months after treatment, could be only be found for the online group.

1. Introduction

Depression is a one of the most common mental disorders among adults. It is associated with significant impairments in health and functional status, as well as with high economic and personal costs (Andrews et al., 2001). The early age of onset, high prevalence rate and often long-term nature of depression make it a major public health problem that generates large direct and indirect costs for the depressed person as well as for society (Richards, 2011). In Europe for the year 2010 the annual cost of depression per patient was estimated at €3034 with an estimated number of 30.3 million people affected (Olesen et al., 2012). These costs are incurred despite the fact that the vast majority of people suffering from depression do not access treatment (Collins et al., 2004). Barriers to assessing effective treatment include fear of stigma, lack of time, long waiting times, geographic distance to mental health services, or unwillingness to disclose psychological problems (Collins et al., 2004). Internet-based interventions may help to overcome these obstacles. Andersson and Cuijpers found a strong influence of therapist support on treatment outcome in their 2009 meta-analysis of 12 internet-based randomized controlled trials for depression, (Andersson and Cuijpers, 2009). Computerized interventions with therapist support showed a mean between-group effect size of $d=.61$, which is comparable with face-to-face treatment for depression, whereas interventions with little or no therapist contact had significantly smaller treatment effect sizes, averaging $d=.25$. A recently published meta-analysis, including data from 25 controlled trials, supports these previous findings and found effect sizes ranging from $d=.10$ to $d=1.20$ (Johansson and Andersson, 2012). The authors categorized the studies by type of human contact. Category 0 was used for no human contact at all throughout the treatment, category 1 for therapist contact only before treatment,

☆Trial registration: Australian New Zealand Clinical Trial Registry: ACTRN12611000563965.

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http://dx.doi.org/10.1016/j.jad.2013.06.032

category 2 was contact only during the treatment and finally category 3 was where therapist contact took place before, during and after the intervention. The effect sizes were d=.21, .44, .56 and .76. These results indicate that higher levels of human contact yield larger effect sizes. This matches other findings of a significant correlation between the amount of therapist time in minutes per participant and the between-group effect sizes of internet-based interventions (Palmqvist et al., 2007). Moreover, studies on entirely self-guided programs have shown not only reduced treatment effects, but also substantial attrition rates of up to 41% (Christensen et al., 2006a, 2006b; Clarke et al., 2005, 2002; Kaltenthaler et al., 2008). In summary, it can be concluded that therapist-assisted online programs for depression yield medium to large effect sizes.

However the question remains of whether internet-based therapies for depression are equally as beneficial for patients as standard face-to-face treatments. Only a few studies have directly compared computerized interventions with face-to-face interventions. Spek and colleagues evaluated an 8 week internet-based intervention for non-typical subthreshold depression in people aged 50 and older compared to 10 weekly face-to-face group sessions and a waiting-list condition (Spek et al., 2007). No significant treatment effect differences were found between the face-to-face group intervention and the internet-based intervention. Other studies have evaluated and compared online versus face-to-face therapies for tinnitus (Kaldo et al., 2008), social phobia (Andrews et al., 2011), panic disorder (Bergstrom et al., 2010), spider phobia (Andersson et al., 2009), and relaxation (Carlbring et al., 2007) and found no significant differences between the two settings. Only one study, evaluating an intervention for body image and eating disorders, showed a significant difference between the two groups (Paxton et al., 2007). Post-treatment improvements were larger in the face-to-face than in the internet-based intervention. Although there is mounting evidence that internet-based interventions for depression are effective and there is support for the assumption that therapist guided interventions are favorable over unguided interventions, to our knowledge, no randomized controlled trial for depression has been conducted to compare treatment efficacy in the two treatments (online vs. face-to-face) in an experimental setting.

Recognizing that time-intensive psychotherapies present an important barrier to mental health care use, the present study used non-inferiority methodology to compare the efficacy of a brief 8-week internet-based CBT intervention with high therapist involvement for depression with a face-to-face CBT intervention. The Internet-based intervention was not self-guided and the treatment consisted of structured writing assignments with an individualized feedback from the therapist. The treatment manual was based on a German CBT treatment manual for depression (Hautzinger, 2003). Patients from both groups received the same course of treatment over the same timeframe and the time of contact between therapist and patient was equal for both groups. Primary outcomes of the study were depression, secondary symptoms, anxiety, general health, and depression-related outcomes (e.g. suicidal ideation, hopelessness and negative automatic thoughts). It was predicted that participants in both groups would have significant reduced symptoms of depression after treatment and that the improvements would be maintained at a 3-month follow-up assessment. Further, it was hypothesized that the groups would not differ significantly at either post-treatment or 3-month follow-up for both primary and secondary outcomes.

2. Methods

2.1. Ethics statement

Ethical approval for the trial was given by the institutional review board at the University of Zurich. Signed informed consent was given by all participants by fax or post. The protocol for this trial and supporting CONSORT checklist are available as supporting information; see Checklist S1 and Protocol S1.

2.2. Participants and recruitment

Potential participants were recruited in the area of Zurich, Switzerland, through advertisements in newspapers, the depression website of the university, local internet news forums and depression self-help groups, advertisements in supermarkets and pharmacies, and local press releases. Potential participants were informed that they would be randomized either to the online or the face-to-face group, and that Internet access was a prerequisite. Applicants indicated their interest in the study by contacting the intake coordinator via e-mail or telephone. The intake coordinator sent a reply e-mail with a patient information sheet and the inclusion and exclusion criteria. Inclusion

Table 1
Demographic and descriptive characteristics of the online and face-to-face groups at baseline.

	Online group (n=32)	Face-to-face group (n=30)	Group comparison
Age (M, SD)	37.25 (11.41)	38.73 (11.41)	t=−,50, p=.61
Age range	20–67	19–62	
Gender (% female)	78%	50%	$\chi^2(1)=5.35$, $p<.05$
Educational level (%)			$\chi^2(32)=1.46$, p=.48
Primary education	16	27	
Secondary education	37	27	
University	47	47	
Marital status (%)			$\chi^2(3)=2.62$, p=.45
Single	59	57	
Partnership/married	19	20	
Divorced	16	7	
Widowed	6	17	
Professional status (%)			$\chi^2(4)=4.4$, p=.52
Full-time work	72	67	
Sick leave	3	10	
Unemployed	22	20	
Retired	0	3	
No current antidepressants (%)	91	70	$\chi^2(3)=4.82$, p=.18
BDI-score, pre-test (M, SD)	22.96 (6.07)	23.41 (7.63)	t=−,25, p=.80
BDI pre-test (11–17) in %	16.7	23.3	$\chi^2(2)=.44$, p=.80
BDI pre-test (18–29) in %	63.3	56.7	
BDI pre-test (≥30) in %	20	20	
Completer in %	78	93	

criteria were a score of at least 12 on the Beck Depression Inventory (BDI-II) (Beck et al., 1996) and age 18 years or older. Potential participants were excluded if they were (1) currently receiving treatment elsewhere, (2) also suffering from substance abuse or dependence, (3) had been on antidepressant medication for less than 4 weeks, (4) not fluent in German. Further exclusion criteria were high risk of suicide, psychotic symptoms, post-traumatic stress disorder, anxiety, phobia and bipolar disorder. Applicants who indicated that they met the study requirements entered an online screening procedure, data from which were later used as pre-test measures. After confidentiality issues had been addressed, eligible applicants returned a signed informed consent form–which informed them about potential risks and benefits of study participation–by fax or post. Participants were randomly assigned by the study coordinator to either the internet-based intervention group or the face-to-face group after recruitment to the study. Excluded applicants were informed immediately about other available forms of treatment. Applicants excluded because of a high risk of suicide were contacted by telephone by the study coordinator. Demographic characteristics of the sample are presented in Table 1. A total 191 respondents applied for the treatment. The numbers of patients and reasons for exclusion are specified in the flowchart (see Fig. 1). Participants were recruited between November 2008 and February 2010.

2.3. Procedure

Primary and secondary outcome measures were collected at pre-treatment, post-treatment and 3-month follow-up. All measures for both intervention groups were administered through online diagnostics. A number of studies have shown that online format questionnaires produce results as valid as pen-and-paper questionnaires (Fidy, 2008; Hollandare et al., 2010). The 62 applicants included in the study were randomized by a true random-number service (http://www.random.org) using a 1:1 ratio, with 32 participants randomly allocated to the online group and 30 to the face-to-face treatment group. Randomization was performed by the study coordinator and was not stratified by any participant characteristics.

2.4. Interventions

Online and face-to-face intervention groups received a brief (8 weeks) cognitive-behavioral therapy (CBT) program for depression (Hautzinger, 2003). This German manual is based on the cognitive theory of depression of Beck and colleagues (Hautzinger et al., 2006). The program involved the following CBT modules: (1) introduction, (2) behavioral analysis, (2) planning of activities, (3) daily structure, (4) life review, (5) cognitive restructuring, (6) social competence, and (7) relapse prevention. The life-review module at the mid-treatment time-point aimed to encourage participants to revisit past experiences and to activate positive memories and individual resources in order to achieve a balance between positive and negative memories (Preschl et al., 2012). Further, patients in both groups were given the same psychoeducation and received the treatment modules in the same chronological order. Patients in the face-to-face condition attended one-hour weekly treatment sessions for 8 weeks with their allocated psychologist in the Department of Psychopathology and Clinical Intervention at the University of Zurich. They were also given weekly homework assignments (e.g., daily structure diaries, negative thoughts log).

The online intervention was given as a guided intervention with intensive therapist contact, based on the principles applied in a number of previous studies (Lange et al., 2003; Ruwaard et al., 2007; Ruwaard et al., 2009; Wagner et al., 2006). The internet-based treatment manual was derived from the same cognitive-behavioral treatment modules for depression as the face-to-face intervention (Hautzinger, 2003). The therapist time involved responding to texts, requiring 20–50 min per text, depending on the therapist's experience with internet-based therapies.

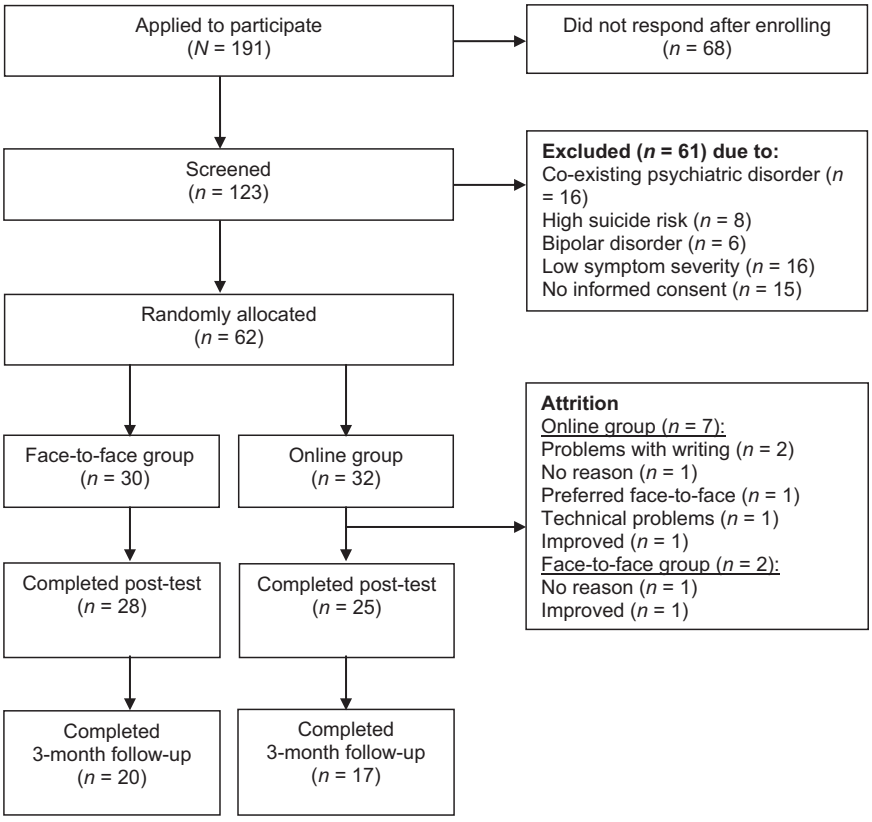

Fig. 1. Flowchart of patient participation.

Each scheduled writing assignment lasted 45 min and patients were given two writing assignments in each week of the 8-week treatment period. Therapists provided individual written feedback within one working day, along with instructions for the next writing assignment. Model responses for the therapists were available, but they also had the option to provide their own commentary or supportive feedback on their patients' texts.

2.5. Therapists

The therapists were six psychologists and psychotherapists. All psychologists were trained in psychotherapy and CBT for depression specifically for this study. The therapists were given special training in therapeutic writing for the online treatment and received regular supervision (face-to-face and online), with therapists in both groups receiving the same amount of supervision. All but one of the therapists was involved in both treatment conditions.

2.6. Outcome measures

All outcome measures were collected at pre-treatment, post-treatment and 3-month follow-up.

2.7. Primary outcome measure

The primary outcome measure of this study was depression assessed with the German version (Hautzinger et al., 2006) of the Beck Depression Inventory-II (BDI; (Beck et al., 1996)), comprised of 21 multiple-choice items assessing specific symptoms of depression. Symptom severity was defined for mild or moderate depression (BDI score: 11–17); moderate to severe depression (BDI score: 18–29); and severe depression (BDI score ≥30) (Hautzinger et al., 2006). Recovery was defined as BDI-II at post-treatment measurement of ≤10.

2.8. Secondary outcome measures

2.8.1. Suicidal ideation

Suicidal ideation was assessed with the Beck Suicide Ideation Scale (BSI) (Beck et al., 1997), a 21-item inventory developed to measure the intensity and recurrence of suicidal ideation in adults. The BSI is one of the few well-validated self-report measures of suicidal ideation The first 5 items make up a brief subscale measuring the presence of suicidal thoughts, either recently (in the last 6 months) or ever in one's life. The BSI has a suggested cutoff score of 3.

2.8.2. Anxiety

Anxiety was assessed using the Anxiety subscale of the German version of the Symptom Checklist created by Derogatis (Franke, 1995). This 10-item subscale covers various symptoms of anxiety, including cognitive and somatic correlates of anxiety and a cut-off score of .64 has been validated to screen for anxiety (Geiser et al., 2000).

2.8.3. Hopelessness

Hopelessness was measured with the Scale for the Assessment of Hopelessness (Krampen and Beck, 1994), a German adaptation of the American Hopelessness Scale (Beck et al., 1974). The Scale for the Assessment of Hopelessness assesses the negative expectations of a person referring to himself, to his environment, or his future life.

2.8.4. Automatic thoughts

The German version of the Automatic Thoughts Questionnaire-Revised (ATQ-R, (Kendall et al., 1989), German version (Pössel et al., 2005)) measures positive and negative automatic thoughts which are specific to depressive thinking. The German ATQ-R includes the three subscales (1) *negative thoughts*, (2) *well-being*, and (3) *self-confidence*.

2.8.5. Treatment satisfaction

The overall treatment satisfaction was asked with a one-item question ("How satisfied have you been with the intervention?") on a 10-point Likert scale (1=very dissatisfied, 10=extremely satisfied).

2.9. Exclusion criteria

2.9.1. Risk of psychosis

Risk of psychosis was measured using the Dutch Screening Device for Psychotic Disorder (Lange et al., 2000), a seven-item inventory that is a good predictor of psychotic episodes. Because no data are yet available from a German norm group, the Dutch norm data were used. A score of 13 has been identified as providing a cutoff for identifying risk of psychosis.

2.9.2. Phobia

The German version of the Symptom Checklist by Derogatis (Franke, 1995) was also used to test for phobias. The Phobia subscale contains seven items assessing severity of phobic symptoms.

2.9.3. Post-traumatic stress

The Post-Traumatic Stress Scale 10 (Maercker, 1998), a short screening instrument tapping DSM-III symptoms of post-traumatic stress disorder, was used to measure symptoms of post-traumatic stress.

2.10. Statistical analysis

Statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS), version 19.0 for MAC. Independent t-tests and χ^2-tests were used to estimate baseline between-group differences in demographics and pre-treatment measures. To evaluate recovery, the BDI-II was used. Changes of prevalence of depression at pre-treatment and post-treatment were calculated and analyzed with χ^2-tests. Differences between the online and face-to-face interventions were primarily investigated by mixed-design ANOVAs with time as the within-subject factor and group as the between-subject factor. All post-treatment and 3-month follow-up analyses were based on an Intention to treat (ITT) design. Missing data were addressed by carrying forward the first available data (baseline observation carried forward; BOCF) principle. To examine the magnitude of change in mean symptoms between baseline and post-treatment and between baseline and 3-month follow-up, we calculated effect sizes using Cohen's *d* for repeated measures. An effect size of $d=.80$ for a psychological treatment is typically considered large (Cohen, 1988). Finally, *t*-tests and χ^2-tests were used to identify any differences between dropouts and completers.

3. Results

Table 1 shows baseline sociodemographic characteristics of participants in the online and face-to-face conditions. There were no significant differences for most of the baseline variables, however, despite randomization, there was a significantly higher

Table 2
Results of mixed design ANOVAs and effect sizes for the online and face-to-face groups at baseline, post-treatment, and 3-month follow-up: intention-to-treat analysis.

	Time	Online group		Face-to-face group		Between-group difference	Effect size, *d* between-group post-treatment	Effect size, *d* between-group 3-month Follow-up
		M	*SD*	*M*	*SD*			
BDI	Pre	22.96	6.07	23.41	7.63	F(1,59)=.01, p=.92	.00	.61
	Post	12.41	10.03	12.33	8.77	F(1,34)=2.88, p=.09		
	FU	9.28	7.50	14.47	9.33			
Suicidal ideation	Pre	3.24	4.87	4.40	6.48	F(1,59)=.23, p=.63	.02	-
	Post	2.27	4.78	2.40	4.80			
	FU	-	-	-	-			
SCL-anxiety	Pre	.95	.52	.92	.56	F(1,58)=.24, p=.62	.29	.44
	Post	.48	.51	.63	.52	F(1,33)=5.33, p < .05		
	FU	.44	.37	.63	.48			
Hopelessness	Pre	27.59	6.70	28.36	6.41	F(1,60)=.30, p=.58	.13	.47
	Post	20.40	8.66	21.53	8.52	F(1,34)=2.44, p=.12		
	FU	19.18	7.90	23.20	9.07			
ATQ								
Self-confidence	Pre	7.31	3.65	7.00	2.25	F(1,60)=.46, p=.49	.19	.10
	Post	9.40	4.30	8.63	3.64	F(1,34)=.28, p=.59		
	FU	9.25	3.13	8.90	3.69			
Negative thoughts	Pre	35.56	8.08	37.13	9.28	F(1,59)=.07, p=.79	.02	.70
	Post	26.62	15.95	26.27	9.03	F(1,33)=4.70, p < .05		
	FU	21.81	9.15	30.52	15.01			
Well-being	Pre	7.93	2.36	7.63	2.18	F(1,60)=1,07, p=.30	.27	.35
	Post	12.25	5.13	10.93	4.59	F(1,34)=1.71, p=.19		
	FU	12.06	4.66	10.50	4.24			

Note. Online group: n=25 (reduced to n=17 at 3-month follow-up due to dropout); face-to-face group: n=28 (reduced to n=20 at 3-month follow-up due to dropout).

percentage of women in the online group (78%) versus 50% in the face-to-face group, χ^2 (1)=5.35, p < .05. The BDI baseline score was M=22.96 (S.D.=6.07) for the online group and M=23.41 (S.D.=7.63) for the face-to-face group. Symptom severity was high in the total sample: 20% of the participants met criteria for mild or moderate depression (BDI score: 11–17); 60% suffered of moderate to severe depression (BDI score: 18–29); and 20% showed a BDI score ≥30. There was no significant difference between the two interventions groups regarding symptom severity (see Table 1). Only a small subgroup (19%) was taking antidepressants at the beginning of the study, and 53% reported that they had previous experience of psychotherapy.

3.1. Intention-to-treat

Analysis of the change in the primary and secondary outcome measures was conducted using an intention to treat (ITT) analysis. Table 2 presents means and standard deviations of baseline, post-treatment, and 3-month follow-up scores for all outcome measures in both treatment conditions. The ITT analysis yielded no significant between-group difference (online vs. face-to-face group) at any of the pre- to post-treatment measurements. At post-treatment both treatment conditions revealed significant symptom changes compared to pre-intervention levels. The online group showed significant symptom reduction for depression (t=6.98, df=30, p < .001), anxiety (t=5.60, df=31, p < .001), hopelessness (t=5.57, df=31, p < .001), self-esteem (t= −3.25, df=31, p < .01), and automatic negative thoughts (t=3.29, df=31, p < .01). Only suicidal ideation (t=1.18, df=30, p=.24) did not undergo any significant change from pre- to post-treatment in the online group. Similar results and patterns of change were found in the face-to-face group, with the exception of a significant change in suicidal ideation (t=2.45, df=29, p < .05). The between-group effect sizes at post-treatment were small (see Table 2), while within-group effect sizes for the primary outcome depression in the online group (d=1.27) and the face-to-face group (d=1.37) can be considered large. Furthermore, as no significant changes were found in any of the outcome measurements at 3-month follow-up compared to immediately after treatment in the online group, there is an indication that the outcomes remain stable after the treatment. In contrast to this, participants in the face-to-face group showed a significant increase in depressive symptoms from post-treatment to 3-month follow-up (t= −2.05, df=19, p < .05), although all secondary outcome measures remained stable.

A MANOVA for repeated measures showed no significant interaction effect on any primary or secondary outcomes from pre- to post-test, but a significant difference for group effect from post-treatment to 3-month follow-up for anxiety (F(1,33)=5.33, p < .05), automatic negative thoughts (F(1,33)=4.70, p < .05) and a nearly significant effect for depression (F(1,34)=2.88, p=.09).

Pre-treatment to 3-month follow-up within-group effect sizes on the BDI were more favorable for the online-group (d=2.00), compared to the face-to-face group (d=1.04) (see Fig. 2). The corresponding secondary outcomes in the online group for anxiety (d=1.13) versus the face-to-face group (d=.55); hopelessness (d=1.14) versus the face-to-face group (d=.65); and negative automatic thoughts (d=1.59) versus the face-to-face group (d=.52) revealed higher within-group effect sizes for the outcomes of the online group at 3-month follow-up. Further, treatment satisfaction and psychotherapy utilization comparisons between the two intervention groups are detailed in Table 3.

3.2. Attrition

Seven (22%) participants in the online group and two (7%) participants in the face-to-face group failed to finish the treatment (see Fig. 1). Of these nine persons, three stopped treatment without giving any reason and could no longer be reached; two participants stated that writing was not the right approach for them or that they were no longer interested in the treatment program; one participant of the online group preferred face-to-face therapy and therefore discontinued study participation; two experienced sufficient improvement during the course of treatment and one participant discontinued because of technical problems. Completion rates revealed an almost significant difference between the two groups, χ^2(1)=2.88, p=.08. Non-completers in the face-to-face group did not differ from completers in any of

Table 3
Treatment satisfaction and psychotherapy utilization at postmeasurement.

	Online group ($n=25$)	Face-to-face group ($n=28$)	Group comparison
Treatment satisfaction (0–10), (M, SD)	7.88 (1.66)	6.83 (2.03)	$t=.36$, $p=.11$
Treatment duration (%)			
Too short	32	57	$\chi^2(1)=3.37$, $p<.06$
Good	68	43	
Contact between therapist and patient (%)			
Personal	96	91	$\chi^2(1)=1.11$, $p<.57$
Impersonal	4	4	
Do not know	0	4	
Started psychotherapy by 3-month follow-up (%)	25%	20%	$\chi^2(1)=.04$, $p<.83$

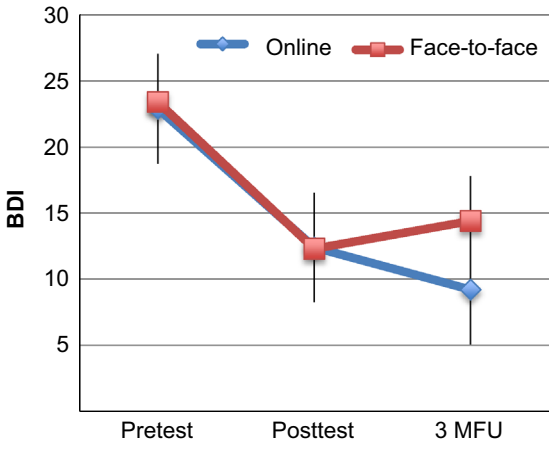

Fig. 2. Online intervention in comparison to a face-to-face group measured with the Beck Depression Inventory (BDI-II) at pretest, posttest and 3-months-follow-up, including standard error.

the demographic variables. In the online group the only demographic difference found was that dropouts were older than completers, $t(30)=-2.33$, $p<.05$. Regarding symptom levels, no significant differences were found between dropouts and completers on any of the baseline measures.

3.3. Treatment recovery

Recovery was defined as BDI-II at post-treatment measurement of ≤10. No difference was found between groups with regard to recovery after treatment $\chi^2(1)=.06$, $p=.80$ or at 3-month follow-up $\chi^2(1)=2.94$, $p=.08$. At post-treatment, 53% in the online-group and 50% in the face-to-face group showed a clinically significant change. Although the increases were not significant, at 3-month follow-up the online group showed a increased recovery rate of 57% while the face-to-face group's recovery rate had decreased to 42%. In the online-group 80% of the participants who reported mild depression at baseline received significant clinical change at posttreatment, compared to 100% in the face-to-face group. In the online group of the moderate to severe depressive participants 67% achieved clinical change compared to 40% in the face-to-face group. In the severe depressed group (BDI ≥30) the online-group achieved 40% significant change, while the face-to-face group achieved 33%. However, no significant difference could be found between the two interventions groups in any of the depression categories.

4. Discussion

The aim of this non-inferiority randomized controlled trial was to test an internet-based intervention against a comparable, traditional face-to-face therapy for depression. To our knowledge this is the first randomized controlled trial for depression comparing both treatment forms with equivalent treatment modules and treatment length. We assumed equal effects for the two conditions. The main finding of this trial is that the internet-based intervention is indeed equally as effective as face-to-face therapy for depression. This is in line with previous studies comparing face-to-face therapy with online interventions for other mental conditions (Andrews et al., 2011; Bergstrom et al., 2010; Kaldo et al., 2008; Spek et al., 2007). Furthermore, both interventions showed large within group effect sizes at post-treatment for both depressive symptoms and secondary outcomes, which confirms findings of Nieuwsma and colleagues that a brief intervention for depression can be effective and comparable to standard duration of psychotherapy (Nieuwsma et al., 2012). The within group effect size in the online-group ranged from $d=.91$ to $d=1.27$ for depression, anxiety and hopelessness. These effect-sizes confirm the findings of Johansson et al. (2012), who found the largest effect sizes for interventions with a high therapist involvement in their review. The high therapist involvement in our study therefore seems to play a major role compared to treatment effects of self-guided interventions for depression (Johansson and Andersson, 2012).

However, analysis revealed that from post-treatment to 3-month follow-up a difference between the internet-based intervention and the face-to-face group could be found. Symptom reductions were maintained for all primary and secondary outcomes for the online group three months after treatment. In contrast to this, participants in the face-to-face group significantly worsened from post-treatment to 3-month follow-up in terms of depressive symptoms. Further, significant differences were found for the face-to-face group from post-treatment to the 3-month follow-up for symptoms of anxiety and automatic negative thoughts and a nearly significant effect was observed for depression. Altogether it appears that the treatment effects from pre-treatment to 3-month follow-up were larger in the online group than in the face-to-face group. Moreover, at the 3-month follow-up more participants in the online group indicated clinically significant changes than in the face-to-face group. Reasons for this might include that the online intervention has less personal guidance and therefore puts a stronger focus on self-responsibility to conduct the treatment modules and homework assignments than the face-to-face intervention. This might evoke a stronger, longer-lasting sense of self-efficacy in handling negative thoughts and depressive behavior. Further, no significant difference could be found regarding treatment satisfaction in both groups. 96% of the participants in the online group described the contact between therapist and themselves as personal, compared to 91% in the face-to-face group. This conflicts with previous findings of Kaldo et al. (2008), who found that the credibility rating of their internet-based intervention was significantly lower than that for the face-to-face group intervention. Interestingly, there was an almost

significant difference regarding opinions about the treatment duration in our study. While only 32% in the online group experienced the treatment as too short, about 57% in the intervention group found the duration of the 8-week program as too short and wished that the treatment could have continued longer.

When looking at the clinical significant change in the different subgroups of symptom severity, we found that in both treatments participants with mild to moderate depressive symptoms showed a higher percentage of recovery. Least recovery was found in the severely depressed subgroup. Further, we could not find any statistical difference between the two interventions and the symptom severity subgroups.

Although these preliminary results provide some evidence that online interventions might be as effective as face-to-face interventions, it remains unclear whether the factors that are responsible for symptom reduction in face-to-face therapy operate in the same way in online therapeutic settings. Therapeutic factors such as missing face-to-face contact, decreased social presence and increased anonymity were originally seen as disadvantages of internet-based interventions. However, for a specific group of patients, it might be exactly these factors that offer an advantage in comparison to conventional therapies. Online participants might be more focused on the structured treatment manual as they are responsible for continuation of the intervention, for example by completing homework assignments. This might lead to a greater treatment manual adherence than in face-to-face therapy. DeRubeis and Feeley (1990) differentiated between two types of adherence to cognitive-behavioral therapies, concrete and abstract adherence. Concrete adherence involves methods to support use by the patients of cognitive-behavioral tools such as cognitive restructuring worksheets, homework assignments and behavioral techniques. In contrast to this, abstract adherence to CBT involves broader discussions of therapy-relevant issues with focus put upon understanding the patients' situation and beliefs and conversations about the patients' wellbeing and therapy progress. In internet-based interventions there is a clear focus on concrete adherence to CBT through use of homework assignments, psychoeducation and behavioral observation techniques. Only a small part of the intervention involves abstract adherence, such as conversations about the patient's current personal situation or broader discussion of disorder-relevant topics. Face-to-face CBT, even when highly structured as in our study, still gives the patients more opportunities to discuss problematic current situations, alongside pure adherence to the treatment modules. The comparison of abstract and concrete adherence in face-to-face versus online therapies should be addressed by future research.

Another important factor for therapeutic interventions is the therapeutic alliance between therapist and patient throughout the intervention. The therapeutic alliance has traditionally been seen as a key element contributing to the treatment success of face-to-face psychotherapy (Horvath and Symonds, 1991). A number of studies have found that the therapeutic alliance significantly influences symptoms of depression as an outcome measure (Krupnick et al., 1996). Internet-based interventions involve less therapeutic contact and are usually restricted to purely text-based and computer-mediated communication. Initial assumptions that internet-based therapeutic relationships are less stable or less positively experienced by the patients have not been confirmed, however. A number of studies have revealed that therapeutic relationships in an online setting are consistently rated as positively and as stable as in face-to-face settings by study participants (Knaevelsrud and Maercker, 2006; Preschl et al., 2011; Wagner et al., 2012). However, the working alliance in internet-based interventions seems to be less predictive of treatment outcome than in face-to-face interventions and the role of the therapist seems to be less prominent than in face-to-face treatments.

The drop-out rates in our study–seven (22%) participants in the online group and two (7%) participants in the face-to-face group–was more favorable for the face-to-face group. This may indicate that the more anonymous online therapeutic relationship is less stable than a face-to-face relationship. Face-to-face interventions involve more social control and it might seem, for a number of participants, inappropriate to dropout of therapy once they get to know the psychotherapist personally. It is easier for patients in online interventions to stop therapeutic communication by simply "disappearing". A study of online romantic relationships revealed that avoidance behavior and discontinuity are more likely in online relationships than in face-to-face relationships (Merkle and Richardson, 2000).

4.1. Limitations

This trial has a number of limitations, which need to be addressed. First, all primary and secondary outcome measures were administered as self-rated questionnaires in an online setting. We aimed to conduct a fully internet-based treatment for the online-group with no personal contact either on the telephone or face-to-face, therefore we decided to conduct the diagnostic procedure entirely through the internet for both groups. However, a structured clinical interview would have allowed a better quality of diagnosis of depression. Second, only one follow-up assessment, at three months, was conducted, therefore we cannot draw any conclusions about the truly long-term effects of the two treatments. Furthermore, the sample used in this study was small, self-referred, relatively well educated, and more than half of the participants already had experience of psychotherapy. Therefore it is unclear whether the results of this study can be generalized to predict efficacy in people who are referred by health professionals or who are less educated. Even though the results regarding the 3-months follow-up are surprisingly in favor of the online-intervention group, it is important to acknowledge that only about two thirds of the participants completed the 3-months-follow-up. Future studies should enroll larger and more heterogeneous samples. Finally, due to our strict exclusion criteria regarding comorbidity and psychosis, a number of applicants were excluded from the study, which also limits the breadth of the conclusions. A number of studies to date have evaluated the efficacy of tailored internet-based interventions for patients with comorbidities (Carlbring et al., 2011; Johansson et al., 2012) and have found encouraging results suggesting that individually tailored interventions are superior to non-tailored interventions. A recently conducted trial explicitly developed for patients with suicidal ideations concluded that this patient group should be considered for future research on internet-based interventions (van Spijker et al., 2010).

5. Conclusion

Depression has become a very prevalent und costly disorder and in most countries therapeutic services do not manage to meet the needs presented by this growing demand. This trial gives preliminary results that a brief internet-based intervention for depression is as effective as comparable face-to-face interventions. Internet-based intervention may be the solution for tackling this epidemic in a more cost-effective way than traditional face-to-face therapies. However, further research is needed to replicate these findings and possible differences in underlying mechanisms between online and face-to-face interventions need to be evaluated.

Role of funding source

This research was supported by the Selo Foundation, Switzerland.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

The authors would like to thank Barbara Preschl, Jenni Keel, Luigina Di Lorenzo, and Regula Usteri, who served as therapists in the study. This study was co-funded by the Werner Selo Foundation.

Appendix A. Supplementary Information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.jad.2013.06.032.

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