

Webcam-Based Online Coaching with Children and Adolescents with Obsessive-Compulsive Disorders – A Single-Case Study

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Abstract: *Objective:* Although there is clear evidence-based knowledge regarding state-of-the-art treatment for pediatric obsessive-compulsive disorder (OCD), two main issues remain in clinical practice: (1) Exposure-based cognitive behavioral therapy (CBT) is limited in terms of availability and accessibility or is not adequately provided, and (2) despite large effect sizes of exposure-based CBT, the achieved recovery rates of 50–60 % still show room for improvement. These issues have prompted an increasing focus on delivering exposure-based CBT in new and innovative ways. This study aims to evaluate an intensive therapist-administered online coaching program consisting of exposure with response prevention via video teleconferencing (VTC) as an add-on to weekly outpatient CBT (blended therapy). *Method:* The blended therapy is examined in $n = 5$ children and adolescents with OCD using an AB design and multi-informant ratings. *Results:* This single-case study shows promising results, indicating that a decrease in OCD severity and related functional impairment can be attributed to blended therapy. Moreover, satisfaction with online coaching was high. *Conclusions:* Despite some principal limitations, the results support the effectiveness and feasibility of blended therapy.

Keywords: video teleconference, telemental health, blended therapy, exposure with response prevention, OCD

Webcam-basiertes Online-Coaching bei Kindern und Jugendlichen mit Zwangsstörungen – eine Einzelfallstudie

Zusammenfassung: *Fragestellung:* Obwohl der evidenzbasierte Forschungsstand hinsichtlich der State-of-the-art Behandlung von Zwangsstörungen im Kindes- und Jugendalter eindeutig ist, bestehen weiterhin zwei Hauptprobleme in der klinischen Praxis: (1) Die Verfügbarkeit und der Zugang zu expositionsbasierter kognitiver Verhaltenstherapie (KVT) sind begrenzt oder es mangelt an adäquaten Versorgungsangeboten, und (2) trotz hoher Effektstärken expositionsbasierter KVT zeigen die erreichten Erholungsraten von 50–60 % noch Raum zur Verbesserung. Dies führt zu einem zunehmenden Fokus auf neue und innovative Wege, expositionsbasierte KVT anzubieten. Ziel der vorliegenden Studie ist die Evaluation eines intensiven therapeutischen Online-Coachings, bestehend aus Expositionen mit Reaktionsmanagement über Videokonferenz als Ergänzung zur wöchentlichen ambulanten Psychotherapie (blended Psychotherapie). *Methodik:* Die blended Psychotherapie wird in einer Einzelfallstudie mit AB-Plan in einer Gesamtstichprobe von $n = 5$ Kindern und Jugendlichen mit Zwangsstörungen untersucht, dabei werden verschiedene Beurteilungsperspektiven berücksichtigt. *Ergebnisse:* Die Studie zeigt vielversprechende Ergebnisse, die auf einen Abbau der Zwangssymptome und Funktionsbeeinträchtigung durch die blended Psychotherapie hinweisen. Außerdem wird eine hohe Zufriedenheit mit dem Online-Coaching berichtet. *Schlussfolgerungen:* Neben wenigen grundsätzlichen Limitationen unterstützen die Ergebnisse die Effektivität und Umsetzbarkeit der blended Psychotherapie.

Schlüsselwörter: Videokonferenz, Telemedizin, blended Psychotherapie, Exposition mit Reaktionsmanagement, Zwangsstörungen

Introduction

Cognitive behavioral therapy (CBT), including exposure with response prevention (ERP) (in the following: exposure-based CBT), in severe cases with additional pharma-

cotherapy, is based on the current state of research (e.g., Franklin et al., 2011; McGuire et al., 2015; Öst et al., 2016; Pediatric OCD Treatment Study [POTS] Team, 2004; Rosa-Alcázar et al., 2015; Sánchez-Meca et al., 2014; Watson & Rees, 2008), considered as the first-line treatment

according to internationally recognized guidelines (Deutsche Gesellschaft für Kinder- und Jugendpsychiatrie, Psychosomatik und Psychotherapie e.V. [DGKJP], 2021; American Academy of Child and Adolescent Psychiatry [AACAP], 2012; National Institute for Health and Care Excellence [NICE], 2005).

Although there is clear evidence-based clinical knowledge regarding state-of-the-art treatment for pediatric OCD, two main issues are apparent in clinical practice: (1) Exposure-based CBT is limited in terms of availability and accessibility or is not adequately provided (Krebs et al., 2015; Nair et al., 2015; Valderhaug et al., 2004; Whiteside et al., 2016). In particular, therapist-guided ERP, which means that the therapist is present during ERP and guides the patient during the assignments in real-time instead of only explaining and preparing ERP for a patient's self-directed implementation at home as well as carrying out ERP assignments in the triggering environment ("real-life exposure"; Wolters et al., 2017), seems to be highly relevant for successful treatment (Franklin et al., 2011; Greist et al., 2002; Krebs et al., 2015; Rosqvist, Thomas & Egan, 2002; Tolin, 2007). (2) Despite the large effect sizes of exposure-based CBT (including self-directed and therapist-guided ERP), the recovery rates at posttreatment lie in the 50 % to 60 % range (e.g., McGuire et al., 2015: 57 %; Öst et al., 2016: 52.7%), meaning that there is still room for improvement.

These issues have prompted an increasing focus on delivering exposure-based CBT in new and innovative ways, including:

1. *Increased session intensity.* Typically, weekly 1-hour CBT sessions are conducted. Investigations of intensive exposure-based CBT (including therapist-guided ERP) have shown that programs with highly frequent sessions in individual or group formats (e.g., 5-day intensive ERP treatment; Whiteside & Jacobson, 2010; Whiteside et al., 2014, 2018) can be considered an alternative, especially for those patients who do not have access to local first-line treatment and may lead to a more rapid relief for affected patients and their families (Farrell et al., 2016b).
2. *Use of digital technology.* Telemental health enables assessment and treatment to be provided at a distance (Hilty et al., 2013). This has the obvious advantage that first-line treatment can be delivered regardless of transportation problems or geographical distance between the patient and the (qualified) therapist. CBT delivery via different telemental health approaches and across different psychiatric conditions has shown promising pre-post improvements overall (for an overview, see Richardson et al., 2010; Rooksby et al., 2015; Vigerland et al., 2016). In the research field of telemental health and OCD, only a small number of investigations have

included children and adolescents (see Babiano-Espinosa et al., 2019; Wolters et al., 2017). In particular, the potential of exposure-based CBT (including therapist-guided ERP) via video conferencing (VTC) in pediatric OCD has been supported. In sum, there is evidence for the effectiveness (Comer et al., 2014; Farrell et al., 2016a; Hollmann et al., 2021) and efficacy (Comer et al., 2017; Storch et al., 2011); the outcomes regarding OCD severity and related functional impairment are superior to waitlist controls (Storch et al., 2011) and comparable to the outcomes when the same exposure-based treatment is carried out clinic-based face-to-face (Comer et al., 2017). However, the outcomes were almost exclusively clinician-rated, although correlations between different raters have usually been low (Canavera et al., 2009; De Los Reyes et al., 2015). Long-term effects over 3 and 6 months were broadly found to be stable (Comer et al., 2017; Storch et al., 2011), and parent-rated (Comer et al., 2014, 2017; Storch et al., 2011; Hollmann et al., 2021) and patient-rated (Hollmann et al., 2021) treatment satisfaction was high.

In contrast to Storch et al. (2011), Comer et al. (2014, 2017) and Hollmann et al. (2021), who examined exposure-based CBT conducted entirely via VTC, Farrell et al. (2016a) found positive effects when using webcam-based psychotherapy as a maintenance treatment after a brief, intensive face-to-face delivered CBT. Moreover, technological advances can be used as an augmentation strategy, in the form of an add-on to face-to-face CBT. In adult populations with different psychiatric disorders, at least some findings lend support to the assumption that this combination (blended therapy) might be even more effective than telemental health approaches or traditional CBT as stand-alone treatments (e.g., Andersson et al., 2019; Erbe et al., 2017). However, to date, there are hardly any blended therapy studies regarding pediatric OCD (e.g., Babiano-Espinosa et al., 2021; Salemink et al., 2015).

To the best of our knowledge, only one recently published study by Babiano-Espinosa et al. (2021) has examined webcam-based ERP sessions (and an app) as an adjunct to outpatient face-to-face CBT in children and adolescents with OCD, even though the advantages especially of using the VTC method as an add-on are clear: Travel time and costs are reduced; treatment can be intensified, likely leading to more rapid relief; and ecological validity might be improved, as therapist-guided treatment can be easily offered in settings outside of clinics where OCD symptoms often mainly occur, thus increasing and improving generalization and treatment effects (Comer et al., 2017; Wolters et al., 2017). Babiano-Espinosa et al. (2021) found blended treatment in pediatric OCD to be a feasible intervention with positive treatment outcomes on

clinician-rated OCD and well accepted by patients and parents. Due to the described advantages and as results of this first published study are promising, comparable replication is needed.

The current study aims to evaluate an intensive therapist-administered online coaching program consisting of ERP via VTC as an add-on to weekly outpatient CBT in children and adolescents with OCD. Within a single-case study design, we evaluate effects based on multiinformant ratings and consider the following questions: (1) Can ERP via VTC be implemented in the patients' homes? (2) Do therapists and patients experience ERP via VTC as helpful? (3) Does blended therapy reduce clinician-rated, patient-rated, and parent-rated OCD symptoms and functional impairment?

Methods

Inclusion Criteria

Children and adolescents were included in the study if they were aged between 8 and 18 years and had been diagnosed with OCD (F42.x) according to the 10th revision of the International Classification of Diseases and Related Health Problems (ICD-10; World Health Organization, 2004). The OCD diagnosis was assessed in a semistructured clinical interview with the patient and the parents using the Diagnostic Checklist for OCD (Diagnose-Checkliste für Zwangsstörungen, DCL-ZWA; Döpfner & Görtz-Dorten, 2017). OCD severity, measured using the German version of the Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS-D; Goletz & Döpfner, 2018), had to be at least in the moderate range, which corresponds to a CY-BOCS-D total score ≥ 16 (AACAP, 2012). Moreover, OCD had to be the primary diagnosis, which meant that, according to clinical judgment, the OCD symptoms had to be the most serious based on a clinical rating of functional impairment and subjective burden during outpatient encounters compared to possible comorbid symptoms. Comorbid symptoms were assessed based on standardized questionnaires and diagnostic checklists.

OCD-specific medication was allowed if no change of dosage or medication took place during the time of study participation (clinical rating). Pharmacotherapy was conducted independently. Further inclusion criteria were (a) $IQ \geq 80$, (b) outpatient CBT and ERP had to be feasible and indicated, (c) no expected other psychotherapy was allowed during study participation, (d) patients had to have a WiFi connection at home, and (e) patients and parents had to give their written informed consent for study participation.

Study Design and Treatment

This study was registered at the German Clinical Trials Register (identifier study: DRKS00016619) and approved by the Medical Ethics Committee of the University Hospital of Cologne.

The effectiveness of the blended therapy was tested in a single-case study with a two-phase AB design (Kazdin, 2011; Levin et al., 2014), including a 3-month follow-up (see Figure 1). It encompassed repeated assessment of outcome measures (see 2.3) in a total of $n = 5$ children and adolescents during two different adjacent intervention conditions: (A) weekly face-to-face CBT and (B) weekly face-to-face CBT with additional online coaching on ERP (blended therapy). CBT in both phases was standardized according to the OCD guideline by Goletz et al. (2018) as well as OCD-specific treatment manuals (e.g., Wewetzer & Wewetzer, 2011) and included, for instance, the treatment of problem-maintaining family, school and other factors and cognitive interventions.

The intervention phase (A) was presented over 3 weeks (t_0 - t_1). During this phase, no ERP was conducted, but preparation for ERP occurred by creating a hierarchy of OCD-triggering recurrent thoughts and situations. During the intervention phase (B), online coaching was conducted two to three times per week as an add-on to the weekly face-to-face CBT for 6 up to a maximum of 18 weeks (t_1 - t_{end} or max. t_7). This involved ERP in the patient's home via VTC. The duration of each online coaching session was between 15 and 100 minutes, depending on the number of exposures conducted within one session, the extent of the exposure, and the time needed for habituation. Additionally, patients had to further practice self-guided ERP assignments every day when online coaching did not take place. As soon as the OCD symptoms were in the subclinical range (as assessed with the CY-BOCS-D rating scale; Goletz & Döpfner, 2018; cut-off score ≤ 7 ; AACAP, 2012), the intervention phase (B) was completed with a further 3 treatment weeks (t_{end}). Otherwise, the online coaching was conducted up to a maximum time of 18 weeks (t_7). The maximum of 18 weeks was chosen based on the usually about 12 sessions used in efficacy studies (e.g., Rosa-Alcázar et al., 2015) and our clinical experience with usually larger treatment duration in children and adolescents with OCD based on a study within routine care (Adam et al., in prep.).

The face-to-face CBT was carried out by educationalists or psychologists who were completing 3- to 5-year training in child and adolescent psychotherapy. The online coaching was conducted by a certified child and adolescent psychotherapist or psychological psychotherapist. After every online coaching session, the therapists exchange information about the current status via email, telephone, or

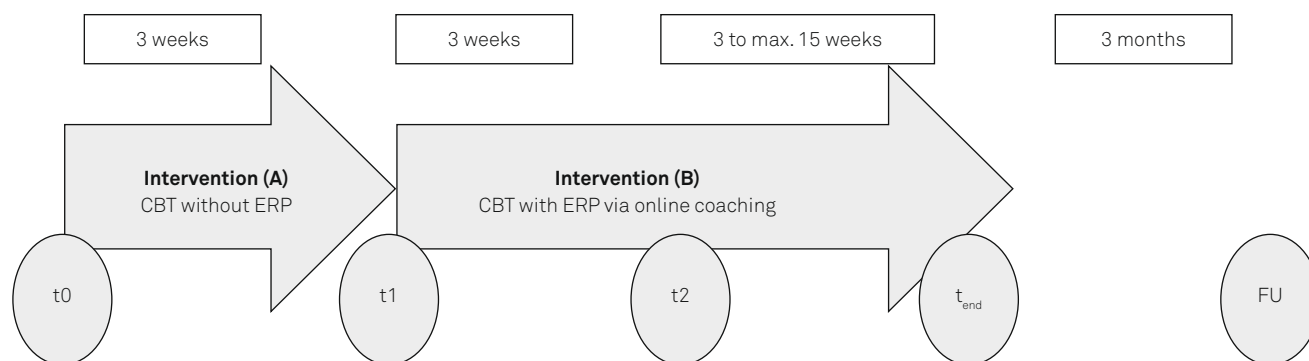


Figure 1. Study design.

Note. FU = follow-up.

through personal contact. Some therapists in training joined the online coaching.

For further information about the technological and practical implementation, see the electronic supplementary material (ESM) 1.

Outcome Measures

Table 1 presents an overview of the multiinformant measures used within the present study. A detailed description is provided in the ESM 2.

The primary outcome was the clinician-rated OCD severity, derived from a short form of the German version of the Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS-D; Goletz & Döpfner, 2018), which was equivalent to the gold-standard version usually used in international studies. OCD was diagnosed based on the clinician-rated Diagnostic Checklist for OCD (DCL-ZWA; Döpfner & Görtz-Dorten, 2017). Patient- and parent-rated OCD symptoms were assessed using the German OCD Inventory for Children and Adolescents (OCD-CA; German: Zwangsinventar für Kinder und Jugendliche, [ZWIK]; Goletz et al., 2020). Further secondary outcomes were functional impairment (OCD-functional impairment list, [OCD-FL]; Adam et al., in prep.), the feasibility of the online coaching (feasibility rating of the online coaching; developed for this study), implementation of self-guided ERP (protocol of self-guided ERP assignments; developed for this study), telepresence (Telepresence Questionnaire based on the Telepresence in Videoconference Scale [TVS; Berthiaume et al., 2018]) and satisfaction with the online coaching (Satisfaction inventory; developed for this study).

Statistical Analyses

For the analyses, scale values were only computed in cases where less than 10 % of the items were missing. To make inferences about the reliability of the effects, we compared the two different adjacent conditions, intervention (A) and intervention (B), by visual inspection with a special focus on changes in OCD symptoms and functional impairment across phases with respect to means, level of OCD symptoms and functional impairment, trend, and latency of change (Kazdin, 2011). Additionally, means and standard deviations were computed for intervention phases. For a more differentiated description of the course of change during intervention phase (B) (e.g., do OCD symptoms further change after initial course of treatment?), this phase was divided into two further phases: online coaching 1 (OC1) and online coaching 2 (OC2). For daily ratings (CY-BOCS-D), OC1 included assessments from t1.1 to t4 and OC2 included assessments from t4.1 to t_end (max. t7). For ratings after every third week (OCD-CA, OCD-FL), OC1 included assessments from t2 to t4 and OC2 included assessments from t5 to t_end (max. t7). Effect sizes were then computed by calculating the difference between pre- and postintervention (B) divided by the initial standard deviation (t1).

To assess the extent of recovery, we computed clinical significance according to Jacobson and Truax (1991) and Jacobson et al. (1999) for the primary outcome CY-BOCS-D (Goletz & Döpfner, 2018) by combining two criteria: (1) To evaluate whether OCD severity was in the clinical or subclinical range at posttreatment, available cut-off values (CY-BOCS-D: total score ≥ 8 ; AACAP, 2012) were used. (2) To evaluate whether the extent of change between pre- and postintervention (B) was statistically reliable, the reliable change index (RCI; Jacobson & Truax, 1991) was calculated. Subsequently, patients were classified into six groups: (1) worsened and clinical range, (2) unchanged and clinical range, (3) worsened and subclinical range, (4) unchanged and subclinical range, (5) improved and clinical range, (6) improved and subclinical range.

Table 1. Outcomes and multiinformant assessment

Assessment area and assessment points	Patient rating	Parent rating	Therapist rating*
OCD symptoms and severity			
– Preintervention (t0 and t1) and after every third intervention week	OCD-CA	OCD-CA	
– Daily (Monday to Friday) from t0 onward and throughout both intervention phases			Short form of the CY-BOCS-D rating scale
– Postintervention (B)			CY-BOCS-D item assessing global improvement
– Pre- and postintervention (t0 and t _{end})			DCL-ZWA
Functional impairment			
– Pre-intervention (t0 and t1) and after every third intervention week	OCD-FL	OCD-FL	
Feasibility of the online coaching			
– Every online coaching session			Feasibility rating of the online coaching
Implementation of self-guided ERP assignments			
– On every day when therapist-supported online coaching did not take place	Protocol of self-guided ERP assignment		
Telepresence			
– Postintervention (B)	Telepresence Questionnaire		
Satisfaction with the online coaching			
– After every third intervention week during intervention phase (B)	Satisfaction inventory		Satisfaction inventory

Note: *The therapist ratings were all conducted by the certified child and adolescent psychotherapist who conducted the online coaching. OCD-CA = German OCD Inventory for Children and Adolescents, CY-BOCS-D = German version of the Children's Yale-Brown Obsessive-Compulsive Scale, DCL-ZWA = Diagnostic Checklist for OCD, OCD-FL = OCD-functional impairment list, ERP = exposure with response prevention.

cal range, (4) unchanged and subclinical range, (4) improved and clinical range, and (6) improved and subclinical range.

Results

Participants

Patients were recruited between December 2018 and November 2019, either at their first consultation or during their first phase of psychotherapy at the Outpatient Clinic at the School for Child and Adolescent Cognitive Behavior Therapy at the University Hospital Cologne (routine care).

A total of seven patients were included, two of whom dropped out after the first 3 to 4 online coaching weeks due

to a lack of time to carry out the additional (to the weekly face-to-face psychotherapy) ERP sessions via VTC or low burden from OCD symptoms and lack of motivation for therapy. Table 2 summarizes the demographic and clinical characteristics of the sample ($n = 5$) as well as treatment characteristics. Patients were aged 13 to 18 years ($M = 15.65$, $SD = 2.12$); two participants were boys, and three participants had comorbid disorders. Four patients were receiving OCD-specific medication. While three of these were already receiving their medication prior to study inclusion, the fourth had to be adjusted with medication during study participation: In particular, obsessions increased, and the patient was permanently distracted by different intrusive thoughts during the ERP sessions, meaning that it was difficult to successfully complete the ERP sessions, and barely possible without medication. The medication started directly after t2.

Table 2. Sample and treatment characteristics

Patient	1	2	3	4	5	Overall
Sample characteristics						
Age (years)	14;6	14;2	18;5	13;9	17;5	M = 15.65 (SD = 2.12)
Gender	Female	Male	Female	Male	Female	40% Male
OCD symptoms	Obsessions regarding worries that something bad will happen to family or friends, repeating compulsions	Contamination obsessions, especially regarding the context of school, washing and cleaning compulsions, various strong avoidance behaviors	Obsessions that something bad will happen, especially becoming bad at school, repeating compulsions, controlling, doing things in a special order	Obsessions regarding his identity, fear of losing knowledge and competencies with the consequence of becoming bad at school, repeating and counting specific movements, like blinking	Contamination obsessions and washing compulsions	
Chronification	4 years	1.5 years	3 years	1.5 years	2 years	M = 2.4 years
OCD-specific medication	25 mg clomipramine	150 mg fluvoxamine	none	150 mg sertraline	150 mg sertraline	80% received
Comorbid disorder	none	none	Generalized anxiety disorder (F41.1)	Combined vocal and multiple motor tic disorder [Tourette's syndrome] (F95.2)	Other childhood emotional disorders (F93.8)	60% comorbid disorders
Treatment characteristics						
Mean number of online coaching sessions per week	2.00	2.17	1.33	1.89	2.56	M = 1.99
Percentage of conducted ERP assignments without therapist support	97.8	70.6	90.9	80.4	70.5	M = 82.0
Transmission quality	2.82	2.77	2.56	2.84	2.94	M = 2.79

Note. M = mean, SD = standard deviation

Four of the five patients finished treatment per protocol, while the remaining patient (patient 2, see Figure 1) dropped out at t5 because of low burden from OCD symptoms and lack of motivation for therapy. This patient was nevertheless included in the analyses because more than six online coaching weeks had been conducted.

Treatment Feasibility

The online coaching was planned to be conducted two to three times per week, but not all patients could complete two online coaching appointments every week throughout the intervention phase (B). Overall and despite some minor image and sound interferences or problems with the internet connection, the transmission quality was sufficient. In all cases, ERP was sufficiently observable via the VTC method. All patients conducted most of the self-guided ERP assignments (see Table 2).

Online Coaching Satisfaction and Telepresence

Satisfaction with the online coaching and telepresence are presented in Table 3.

Except for the therapist and patient rating regarding patient 2 ($M = 1.92; 1.88$), treatment satisfaction (range 0 = *not satisfied at all* to 3 = *very satisfied*) was very high during the course of the online coaching (ratings ≥ 2.5). Overall, therapist and patients showed comparable levels of satisfaction with online coaching.

Moreover, the patients predominantly found VTC to be natural and felt as if the therapist was physically present (Telepresence Questionnaire: $M = 87.5\%$ [$SD = 14.8$]).

Treatment Effects

The course of OCD symptoms and functional impairment are presented in Figure 2.

On the primary outcome (CY-BOCS-D rating scale), a decrease in the clinician-rated OCD severity was observable during the intervention phase (B) across patients (except for patient 2), while OCD severity was relatively stable during the intervention phase (A). A reduction in mean OCD severity (Table 4) was found across phases and patients (except for patient 2). Regarding change latency, clinician-rated OCD severity decreased around 3 to 6 weeks after implementing the additional online coaching. Overall (aggregated across all five patients), the effect on clinician-rated OCD severity was large (CY-BOCS-D: $M_{t1} = 20.80$ [$SD_{t1} = 3.27$], $M_{tend} = 7.80$; $ES = 3.98$).

At follow-up, clinician-rated OCD severity was stable or decreased in all cases, except for patient 5. In patient 1, OCD severity decreased between postintervention (B) and follow-up, even though the medication was discontinued after the intervention phase (B).

Courses of parent- and patient-rated OCD symptoms and functional impairment during intervention phase (A) ranged from increase, no change, to decrease. During intervention phase (B), a clear decrease in OCD symptoms and functional impairment was observable in patients 1, 3, and 5. However, there was variability in the course of OCD symptoms and functional impairment of patient 2 and patient 4. Nevertheless, at least some improvement was observed in patient 4 (except for in parent-rated functional impairment). Patient 2 showed a slightly improved functioning level at postintervention (B) but no decrease (compared to intervention [A]) in patient- and parent-rated OCD symptoms.

Overall (aggregated across all five patients), a reduction in the means of patient- and parent-rated OCD and functional impairment across intervention phases was found (see Table 4). The pre-post comparison of intervention

Table 3. Treatment satisfaction and telepresence

Patient	Treatment satisfaction		Telepresence (%)
	Therapist	Patient	
1	2.95	2.92	96.7
2	1.92	1.88	62.6
3	2.85	2.83	91.7
4	2.49	2.87	86.7
5	2.63	2.91	100.0
Overall	$M = 2.57$ ($SD = 0.40$)	$M = 2.68$ ($SD = 0.45$)	$M = 87.5$ ($SD = 14.8$)

Note. M = mean, SD = standard deviation.

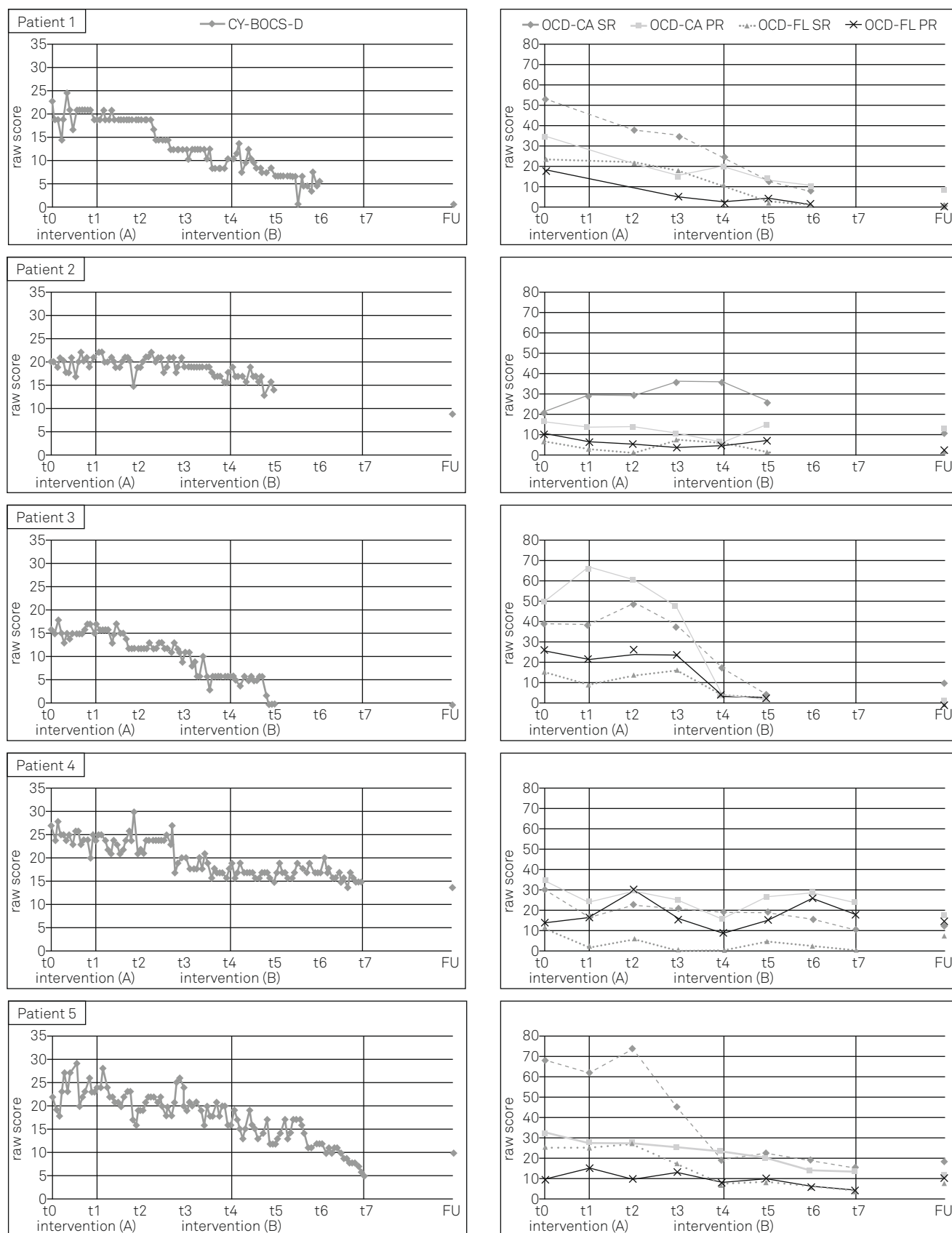


Figure 2. Course of OCD symptoms and functional impairment.
Note. FU = follow-up.

Table 4. Means across phases: *M* (*SD*)

Patient	CY-BOCS-D			OCD-CA			OCD-FL					
	Intervention (A)	OC 1	OC 2	FU	Intervention (A)	OC 1	OC 2	FU	Intervention (A)	OC 1	OC 2	FU
1	19.13 (2.31)	14.18 (3.76)	6.90 (2.70)	0	{53}* [34]*	{32.67 (6.81)} [17.00 (2.83)]	{10.50 (3.54)} [11.50 (2.12)]	{0} [8.00]	{23.00}* [18.00]*	{17.00 (5.57)} [3.50 (2.12)]	{1.50 (0.71)} [2.50 (2.12)]	{0} [0]
2	19.88 (1.36)	19.36 (1.64)	16.47 (1.60)	9	{25.00 (5.66)} [14.50 (2.12)]	{33.67 (4.04)} [9.67 (3.51)]	{26.00} [14.00]	{11.00} [11.00]	{5.00 (2.83)} [8.00 (2.83)]	{4.33 (3.79)} [4.00 (1.00)]	{1.00} [7.00]	{2.00} [2.00]
3	15.50 (1.26)	10.93 (3.56)	4.07 (2.34)	0	{38.00 (0)} [58.00 (12.73)]	{34.33 (16.80)} [36.00 (30.27)]	{3.00} [1.00]	{11.00} [1.00]	{11.00 (4.24)} [23.00 (2.83)]	{9.67 (7.57)} [15.67 (11.85)]	{1.00} [1.00]	{0} [0]
4	24.56 (1.82)	21.44 (3.27)	16.87 (1.27)	14	{23.50 (9.19)} [29.00 (7.07)]	{21.00 (2.00)} [23.33 (7.64)]	{15.33 (4.04)} [26.67 (2.52)]	{12.00} [17.00]	{6.50 (6.36)} [15.00 (1.41)]	{2.00 (3.46)} [18.33 (10.69)]	{2.67 (2.52)} [19.67 (5.69)]	{8.00} [14.00]
5	23.50 (3.08)	20.58 (2.65)	12.6 (3.40)	10	{65.00 (4.24)} [29.50 (3.54)]	{46.00 (27.51)} [25.00 (2.00)]	{18.67 (3.51)} [15.67 (3.79)]	{18.00} [11.00]	{25.00 (0.00)} [12.00 (4.24)]	{17.00 (10.00)} [10.33 (2.52)]	{6.00 (2.00)} [6.67 (3.06)]	{8.00} [10.00]
Overall	20.51 (3.63)	17.30 (4.54)	11.38 (5.72)	6.60 (6.31)	{40.90 (17.97)} [33.00 (15.78)]	{33.53 (8.86)} [22.20 (9.79)]	{14.70 (8.64)} [13.77 (9.20)]	{10.40 (6.50)} [9.60 (5.81)]	{14.10 (9.33)} [15.20 (5.72)]	{10.00 (6.97)} [10.37 (6.69)]	{2.43 (2.11)} [7.37 (7.35)]	{3.60 (4.10)} [5.20 (6.42)]

Note. Intervention (A) = nonexposure face-to-face CBT; t0-t1; OC1 = additional online coaching; t1,1/t2-t4, OC2 = additional online coaching; t4,1/t5- max; t7; FU = 3-month follow-up; clinician rating, {self-report}, [parent report]; *ratings at t1 were missing.

phase (B) showed large effects on patient- and parent-rated OCD symptoms (patient-rated OCD-CA: $ES = 1.35$, $M_{t1} = 35.20$ [$SD_{t1} = 16.75$], $M_{tend} = 12.60$; parent-rated OCD-CA: $ES = 1.76$, $M_{t1} = 33.00$ [$SD_{t1} = 11.70$], $M_{tend} = 12.40$) and functional impairment (patient-rated OCD-FL: $ES = 1.88$, $M_{t1} = 16.00$ [$SD_{t1} = 7.75$], $M_{tend} = 1.40$; parent-rated OCD-FL: $ES = 1.38$, $M_{t1} = 15.20$ [$SD_{t1} = 6.53$], $M_{tend} = 6.20$).

At follow-up, OCD symptoms and functional impairment decreased further in almost all cases.

Table 5 shows the percentage of symptom reduction regarding the CY-BOCS-D total severity score, information about the clinical significance, global improvement, and the OCD diagnosis at posttreatment and follow-up.

Storch et al. (2010) defined a 25% CY-BOCS reduction as treatment response and a 45% to 50% reduction as symptom remission. According to this definition, 60% (three) of the patients showed remission at posttreatment and 80% at follow-up. Using stricter criteria as defined by Mataix-Cols et al. (2016), 40% (two) of the patients showed remission. All patients showed at least a (partial) treatment response. Overall, all patients improved; three patients had subclinical OCD symptoms at posttreatment, and two of them also no longer met the ICD-10 criteria for OCD.

Discussion

This single-case study aimed to evaluate a blended therapy program in children and adolescents with OCD. Overall, the results support (1) the feasibility of ERP via VCT in the patients' homes and show that (2) therapists and patients experienced ERP via VTC as helpful. Moreover, (3) the effectiveness of blended therapy in reducing clinician-, patient-, and parent-rated OCD symptoms and functional impairment is supported.

The study aimed to examine the blended therapy in both children and adolescents with OCD. However, only patients ≥ 13 years participated in this study, which can be explained by the higher prevalence rates of OCD in adolescents (Goletz et al., 2018). Nevertheless, it should be considered that the present findings can only be generalized to adolescents. The gender distribution in our sample corresponds to the previously reported slightly higher rate of affected girls than boys in adolescence (Valleni-Basile et al., 1994). The rate of comorbidity in the sample (60%) broadly corresponds to the comorbidity rates of 62% to 97% found in children and adolescents with OCD (Geller et al., 1998; Wewetzer & Klampfl, 2004).

The patients examined in the present study did not all benefit equally from the intervention, with patients 2 and 4 benefiting the least. According to clinical impression, this was due to different reasons. The burden from OCD symptoms and motivation for therapy of patient 2 were not as

Table 5. Clinical significance of change

		CY-BOCS-D			DCL-ZWA
Patient		Reduction (%)	Clinical significance	Global improvement	OCD criteria (F42.x) still met?
1	Post	72.2	Improved & subclinical	Very much improved	No
	FU	100	Improved & subclinical	Very much improved	No
2	Post	33.3	Improved & clinical	Minimally improved	Yes
	FU	57.1	Improved & clinical	Much improved	Yes
3	Post	100	Improved & subclinical	Very much improved	No
	FU	100	Improved & subclinical	Very much improved	No
4	Post	37.5	Improved & clinical	Much improved	Yes
	FU	41.7	Improved & clinical	Much improved	Yes
5	Post	79.2	Improved & subclinical	Very much improved	Yes
	FU	58.3	Improved & clinical	Very much improved	Yes
Overall	Post	$M = 64.4$	100 % improved 60 % subclinical	100 % improved	40 % no longer met ICD-10 criteria
	FU	$M = 71.4$	100 % improved 40 % subclinical	100 % improved	40 % no longer met ICD-10 criteria

Note. Post = comparison of pre- and postintervention (B), $t1$ vs. t_{end} ; FU = comparison of preintervention (B) and 3-month follow-up, $t1$ vs. FU; M = mean.

high as in the other patients, which ultimately led to drop-out during the course of the study. ERP is always accompanied by emotional stress and requires a high degree of effort from patients. Furthermore, the evaluated intensive psychotherapy is time-consuming and therefore demands even greater willingness, in turn requiring burden from OCD symptoms and motivation for therapy. As shown in Figure 1, the functional impairment of patient 2 was very low throughout the study participation. As such, OCD symptoms did not lead to high impairment (especially due to strong avoidance behavior and the family's accommodation of the symptoms), for instance, in daily life. Over the course of the study, patient 4 developed predominantly obsessive thoughts, which generally seem to be more difficult to treat with ERP, irrespective of the VTC method (Adam et al., in prep.; Hoffmann & Hofmann, 2018). Clinician-rated and patient-rated OCD symptoms decreased after t2 and thus also after adjusting the patient with medication. Hence, it cannot be clarified whether the improvement is attributable only to the medication or to both the blended therapy and the medication.

To conclude, the results indicate that especially specific patient characteristics such as motivation for therapy as well as specific OCD-related characteristics such as functional impairment may determine treatment feasibility and outcome.

Overall, there were only minor technical issues. Two patients had to be provided with a smartphone because their OCD led them consider their own smartphone to be contaminated. Touching their smartphone was an ERP exercise itself and classified as too difficult and challenging for the beginning of the treatment. In all cases, the ERP was sufficiently observable via the VTC method, especially due to the possibility to choose the observation perspective using a webcam or a chest harness depending on the ERP exercise. The chest harness proved to be particularly suitable for ERP exercises, including hand washing, touching objects with hands, or walking through the home.

A frequently mentioned advantage of internet-delivered CBT is that it provides a time- and cost-saving option to deliver evidence-based treatment (Pim Cuijpers et al., 2008; Vigerland et al., 2016). CBT via VTC does not provide the same savings in terms of time and costs, as the therapist is present during the entire treatment. Nevertheless, the use of this method as an add-on to face-to-face CBT reduces the travel time for both patient and therapist (as the therapist can conduct real-life exposure from their office). Moreover, intensive blended therapy might reduce the entire treatment duration within routine care and may lead to more rapid relief for the patient. Although the total number of intervention hours or therapist-patient contacts may not necessarily be reduced, VTC methods clearly reduce the amount of required face-to-face contact. Another

essential advantage of the VTC method is that ERP can be easily conducted in the situations in which OCD symptoms often occur, which can increase and improve generalization effects. Patients themselves reported that the presence of the therapist in the concrete situation and the feedback (positive reinforcement) made them more motivated and encouraged to carry out the ERP, also independently after the coaching.

Except for patient 2, satisfaction was assessed as very high. Interestingly, patient 2 showed the lowest levels of telepresence and online coaching satisfaction. Hence, the question arises how these variables are related and whether, or in what way, they can be modified to improve treatment outcome. A comparable relation was found in a similar study on blended therapy in patients with tic disorders (Viefhaus et al., 2021).

Comparing the effects found in our study with those (within-subject effect sizes) found in other studies investigating exposure-based CBT via VTC as a stand-alone treatment ($ES_{CY-BOCS} = 2.54$, Comer et al., 2014; $ES_{CY-BOCS} = 1.53$, Comer et al., 2017; $ES_{CY-BOCS} = 2.02$, Hollmann et al., 2021), the effect of the blended therapy on clinician-rated OCD severity ($ES_{CY-BOCS} = 3.98$) was larger in our study.

We found a CY-BOCS-D mean reduction of 64.4%, which corresponded to the reduction (63.8%) found in the blended treatment study by Babiano-Espinosa et al. (2021) and was larger than the CY-BOCS mean reductions of about 34% and 56.1% reported in the studies examining CBT via VTC as stand-alone treatment by Comer et al. (2017), Hollmann et al. (2021) and Storch et al. (2011), respectively. In line with Comer et al. (2014) and Hollmann et al. (2021), all patients improved, while none worsened or showed no change. 40% of the sample within the present study showed a full diagnostic response at posttreatment; this rate was lower than that (60%) reported by Comer et al. (2014). The rate of patients rated as "much improved" or "very much improved" (80%) was higher than that (66%) reported by Hollmann et al. (2021). Generally, when comparing our findings with those of Comer et al. (2014, 2017), it should be considered that the latter authors examined family-based treatment in children (aged 4 to 8 years) and did not include adolescents in their sample. Thus, the comparison should be interpreted with caution.

Besides effects on OCD symptoms, in line with Storch et al. (2011), effects on patient- and parent-rated functional impairment were found (patient: $ES = 1.88$; parent: $ES = 1.38$). While Storch et al. (2011) found that overall treatment gains were predominantly maintained at 3-month follow-up within their RCT, the patients in the present single-case study predominantly showed a further improvement at 3-month follow-up in line with the results of the blended treatment by Babiano-Espinosa et al. (2021).

In contrast to Storch et al. (2011) and Comer et al. (2014, 2017), the present study additionally examined patient and therapist satisfaction, which were also found to be high.

Furthermore, OCD symptoms were not only assessed through clinician ratings. The clinician-rated change ($ES = 3.98$) was considerably higher than patient-rated ($ES = 1.35$) and parent-rated change ($ES = 1.76$). Multimodal assessment is rarely used in the research field of pediatric OCD, and the studies that did integrate multiinformant perspectives found comparable differences (Adam et al., in prep.; Rosa-Alcázar et al., 2015). On the one hand, to explain these differences within the present study, differences between outcome measures have to be considered. The clinician-rated CY-BOCS-D assesses global OCD severity (including impairment, resistance, and control) unrelated to the number and type of symptoms, while the patient- and parent-rated OCD-CA focuses on OCD symptoms across different domains without considering impairment, resistance, and control (Adam et al., 2019).

On the other hand, these differences in rating perspectives might also be due to patients' tendency for dissimulation, especially during pretreatment (Canavera et al., 2009). Parents may underestimate OCD symptoms because obsessions in particular are more difficult for them to observe (Rapoport et al., 2000). Furthermore, rater bias by the clinician cannot be ruled out, for instance, due to the desire to justify one's own efforts. However, larger clinician-rated effects might be also explained by a higher sensitivity of the therapist. In this context, one main limitation of this study has to be mentioned: The clinician rating was neither blinded nor independent. Nevertheless, the patients and parents were at least blinded to the hypotheses. Furthermore, Lewin et al. (2012) found that treating therapists were a reasonable alternative to blind and independent evaluators regarding improvement ratings of pediatric OCD.

Overall, due to a missing control group as well as the small sample size, the effect sizes should be interpreted with caution.

Regarding latency of change as one criterion by which to judge whether change can be attributed to intervention and not to chance (Kazdin, 2011), clinician-rated OCD severity in particular did not decrease rapidly at the point when additional online coaching was introduced (t1), but rather decreased around 3 to 6 weeks after the implementation of the additional online coaching (see Figure 2). On the one hand, this finding may be due in particular to the CY-BOCS-D rating categories: For example, time spent on OCD is classified in time periods (e.g., 1 to 3 hours), meaning that an improvement in time spent on OCD is not (necessarily) immediately reflected in the CY-BOCS-D total

score. On the other hand, it seems plausible that a noteworthy and measurable change only occurs after some practice of the ERP exercises.

The present study employed a single-case design to gather experience and enable statements to be made about the course of OCD symptoms and resulting functional impairment as well as the effect of the blended therapy. One main limitation lies in the two-phase AB design used in this study. To enhance the scientific credibility, the intervention was replicated across five patients (Levin et al., 2014). However, a multiple-baseline design, e.g., including varying duration of intervention phase (A), would have enabled us to rule out more threats to validity. Nevertheless, the present findings do reveal some trends. Further investigations are needed, including RCTs and studies with larger sample sizes. Besides more research to evaluate blended therapy, in particular, more RCTs are needed to examine the efficacy of blended treatments compared to nonblended treatments.

Overall and despite some limitations, this single-case study shows promising results regarding blended therapy in patients with OCD, indicating that a decrease in OCD severity and related functional impairment can be attributed to the additional ERP via VTC, or rather blended therapy (intervention phase [B]). Of course, based on the present findings, it is not possible to judge whether blended therapy might provide a solution to the two main issues in clinical practice that were described in the Introduction. At the very least, however, it does seem to represent a promising possibility to improve (1) patient care, especially for those patients who are unable to make use of such an evidence-based intensive treatment through on-site appointments, and (2) recovery rates.

Electronic Supplementary Material

The electronic supplementary material (ESM) is available with the online version of the article at <https://doi.org/10.1024/1422-4917/a000904>

ESM 1. Information on software, hardware, and equipment used for real-time VTC (article).

ESM 2. A detailed description of the outcome measurements (article).

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Conflicts of Interests

Julia Adam, Hildegard Goletz, and Manfred Döpfner are authors of books about obsessive-compulsive disorders and/or diagnostic instruments used in this study, for which they receive royalties from the Hogrefe Publishing Group. The other authors have no potential conflicts of interest.

Open Data

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