Qualitative study

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Acceptance of a sensor-based online psychotherapy for adolescents with obsessive-compulsive disorder (SSTeP-KiZ)

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Abstract

Background and aim: E-mental health interventions with use of cognitive behavioral therapy methods and therapist contact via video have been well established in their effectiveness for various mental illnesses. With the help of sensors worn on the body, relevant contextual information can be made visible. In the SSTeP-KiZ study, the feasibility of a multimodal sensor system was tested, which was used in video-based psychotherapy for adolescents with obsessive-compulsive disorder during therapy sessions in the home environment. The present study investigated the acceptance and satisfaction of participating patients and families with the novel sensor-based therapy approach.

Material and methods: A mixed study design with focus groups was used. In a quantitative longitudinal study, personality characteristics of the study participants and families of the SSTeP-KiZ study were collected. Following the main study, a total of five focus group interviews were conducted with patients, parents, therapists to determine satisfaction and acceptance of the sensor technology. The study was part of the main SSTeP-KiZ study registered by ClinicalTrails.gov (NCT05291611) and used the COREQ-Checklist.

Results: The participants in the focus groups indicated a high level of satisfaction with the therapy method and would recommend the treatment to friends 100% of the time. One factor to be modified appears to be the personal contact design, particularly at the beginning of the therapy. Personality characteristics such as affinity for technology or acceptance of technology were not dependent on the patient's age or gender.

Discussion: The present results indicate that the sensor-based video therapy approach was accepted by patients and families and that the sensor system was experienced as practicable and supportive. To improve the use of sensor technology in psychotherapy further and to adapt the sensor system optimally to the needs of patients, further research involving users in the sense of participatory research is necessary.

Clinical trial registration: [www.ClinicalTrials.gov], identifier [NCT05291611]. The qualitative study is part of the SSTeP-KiZ main study.

Keywords

Video-based cognitive behavioral therapy, obsessive-compulsive disorder, children and adolescents, sensor technology, focus group interviews, acceptance, satisfaction

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Introduction

Mental illnesses in children and adolescents are associated with impairments in psychosocial, physical, and cognitive development.[1] The care of mentally ill children and adolescents represents a complex challenge for the entire healthcare system. The need for children and adolescents living in Germany who require psychotherapeutic support is continuously increasing.[2,3] The existing structural care problem is primarily characterized by a low number of outpatient and inpatient psychotherapeutic therapy places.[2,4]

The possibility of telemedical cross-sectoral care for patients can minimize the existing deficits within the care structure and enable better care for people with mental illness.[5] Meta-analyses of guided internet-based cognitive behavioral therapy (CBT) interventions show average effectiveness for children and adolescents, with classic behavioral therapy content for disorders such as depression, chronic pain, or anxiety disorders.[8] Studies by Hollmann et al. also substantiate the effectiveness of internet-based CBT (iCBT) via video for children and adolescents with obsessive-compulsive disorder (OCD).[9,10] The effects of video-based therapy seem to be similar to those of face-to-face treatment.[58]

Wearable sensors can be used to record objective information such as physiological or behavioral data.[11] By measuring vital parameters such as heart rate or heart rate variability, blood pressure or skin temperature, physical reactions in patients, such as stress experience, can be made visible.[12] Stress reactions play a particularly important role in the treatment of anxiety disorders and obsessive-compulsive disorders as well as post-traumatic stress disorders, as confrontation exercises with stress-inducing situations or places are carried out as part of behavioral therapy.[13–16] Exposures with response prevention are considered the intervention method of choice in the treatment of OCD.[17,18] With conventional exposures, the intensity of the stress reactions and perceived tension as well as the habituation can only be attributed to the information provided by the patients.[19] Naming and concretizing the subjective tension in the context of the exposures is sometimes difficult in adolescents, as children and adolescents are usually not able to assess their tension well in numbers associated with intensities.[20] Video-based treatment with sensor technology opens new treatment options, particularly for patients with OCD.[21,22] The sensors can be used to objectify and largely eliminate the limitations of conventional CBT via video, such as the screen video section and the subjective information provided by patients regarding the experience of anxiety, stress, and tension as well as avoidance behavior during the exercises in the therapy sessions.[10,23]

As the use of technology has proven to be particularly suitable for adolescents in CBT delivered via videoconferencing (vCBT), a technical prototype was developed in a further development of the study already conducted by Hollmann for children and adolescents with OCD (SSTeP-KiZ), which consists of various wearable sensors and transmits the recorded vital parameters of the patients during the therapy sessions and to the therapists via video.[6,24,25] SSTeP-KiZ (Smart Sensor Technology in Tele-Psychotherapy for Children and Adolescents with OCD) was developed as a sensor-based treatment approach for adolescents aged 12 to 18 years with pediatric OCD.[6] It comprised a total of 14 CBT sessions via video, which were conducted based on a digital treatment manual with a primary exposure practice in the home setting of the adolescents. The sensors were worn by the participants in every therapy session and mainly in the exposure sessions, each lasting 45 to 90 minutes. The electrocardiogram (ECG) chest strap was used to measure heart rate and tension during the sessions. The ECG chest strap was used to measure heart rate and heart rate variability to visualize the patient's tension during the therapy sessions. The eye-tracking glasses made it possible to visualize the adolescents' eye movements and gaze behavior. The movement sensors were used to detect compulsive movement behavior.[24] Further detailed information can be found in the paper on the SSTeP-KiZ main study by Klein et al., which describes the sensors used and the parameters measured.[6,59] By wearing various sensors, such as the ECG chest strap to measure the heart rate and the eye-tracking glasses to identify the patient's focus of attention, as well as the movement sensors to document compulsive movement behavior, the therapist receives real-time information about the patient's vital parameters.

Special software and hardware for processing the sensor data (therapist UI) was developed for synchronous recording of the sensor data from the patients and real-time online streaming for the therapists.[25] In a web application for patients and families (patient UI), the course of the obsessive-compulsive symptoms and general emotions were recorded as a digital assessment during the study period.[25]

Without the acceptance of internet-based methods and technologies in psychotherapy by patients, implementation in routine care does not appear possible.[26] Domhardt et al. also considers the aspect of acceptance of technologies in psychotherapy as a relevant factor that requires further research.[7] Studies investigating the acceptance of technologies in internet-based psychotherapy by participants have so far mainly been conducted by therapists.[27,28] A study by Sweeney et al. on the general acceptance and perception of online therapies by adolescent patients shows that adolescents have a high level of media acceptance and would consequently use digital therapies for mental health problems.[29]

Studies show a positive correlation between a high affinity for technology and the acceptance of technology.[30] Technological affinity can be described as a personality trait of a person, which is particularly evident in their interest in and acceptance of technical devices and has a positive effect on their attitude toward technology.[31,32] In contrast to technology acceptance, it does not reflect an attitude, but results from interaction with technologies.[33] Technology acceptance seems to depend on the ease of use and satisfaction

with a system or digital application.[34] A participatory approach with focus group interviews is suitable for measuring user-friendliness and customer satisfaction.[35]

The general aim of the SSTeP-KiZ study was to test the feasibility of the approach of video-based psychotherapy with supporting sensor technology to improve the telemedical treatment of children and adolescents with obsessive-compulsive disorder. Our qualitative study approach provides a valuable insight into the subjective experience of adolescent patients and their parents and enables a differentiated view of the sensor-based therapy approach, including ideas for change from the users' perspective.

Aims

The aim of this study was to use the focus group interviews conducted with users (participants, parents, and therapist team) of the SSTeP-KiZ study to evaluate the use of the sensor system used and satisfaction with the innovative, novel therapy approach and to discuss the advantages and disadvantages of digital therapy interventions.

In addition, personality characteristics such as the participants' affinity for technology and acceptance of technology were measured and examined regarding gender and age-specific differences. The affinity for technology and the acceptance of the participants were also surveyed longitudinally (measured before and after participation in the study).

Research questions and hypotheses

The main research question was: How satisfied are the patients and participants in the focus groups with the innovative treatment approach and the sensor system used, and to what extent is video-based psychotherapy with sensor technology accepted by patients and families?

To answer the main research question, a primarily qualitative approach with research questions (qualitative part of the study) was chosen. The hypotheses (quantitative part of the study) were also intended to provide further information on sociodemographic influences and the context of the sensor-based form of therapy.

Qualitative part of the study

What experiences did patients and families have during video-based psychotherapy with sensor technology?

Where do participating patients and families see potential for development or wish for modifications of the sensor-based therapy approach?

Quantitative part of the study

The technical affinity and acceptance of technology is dependent on and influenced by the age and gender of the participants.

Video-based psychotherapy increases technical affinity and acceptance in technologies.

Material and methods

The study had an explanatory study design, a longitudinal mixed-methods study in the form of a quantitative survey with standardized questionnaires at t0 and t1 of the SSTeP-KiZ therapy phase.[36–38] This was followed by focus groups with qualitative categorization. The data was collected from March 2021 to March 2023. In preparing the manuscript, we used the COREQ-Checklist as a guide[39] Supplemental Appendix 1. The study was approved by the Ethics Committee of the Medical Faculty of the University of Tübingen, Germany (877/2020BO1) and conducted according to the Helsinki declarations. All participants received written information about the study and were informed verbally about the study content, objectives, and risks. The participants and their parents gave their written consent to participate. The participants received no compensation.

Only participants and families who had already taken part in the SSTeP-KiZ study were recruited and included. Exclusion criteria for participation were the subjects' own lack of availability and motivation to participate. General inclusion and exclusion criteria for the SSTeP-KiZ main study are described in another article by Klein et al.[6] The questionnaires of the longitudinal surveys were part of the standard diagnostics (t0), which were carried out before the start of the SSTeP-KiZ study. In the final diagnostic appointments (t1), verbal reference was made to the focus group survey.

Study design

In a linear design, the participants and parents who took part in the SSTeP-KiZ study were asked about their affinity to technical devices and their acceptance of technology at the start (t0) of the video-based psychotherapy and at the end (t1) of the treatment. The survey was based on two standardized questionnaires. The response time for the questionnaires was approximately 10 minutes.

Technology affinity questionnaire—attitude toward and use of electronic devices (TA-EG). The TA-EG questionnaire, which measures attitudes toward and use of electronic devices, was used to measure affinity for technology.[40] The TA-EG consists of 19 items, which are divided into 4 subscales: Enthusiasm for technology, competence in dealing with technology, positive technology consequences, and negative technology consequences. A five-point Likert scale (1 = strongly disagree) to (5 = strongly agree) serves as the response format. A mean value is calculated for each subscale; the mean value of all subscales illustrates the respondents' affinity for technology. The higher the scale value, the greater the technical affinity. The item

"Technical devices increase safety in everyday life" from the subgroup "Perceived positive consequences of technology" was removed due to its inconsistency with the other items in the subgroup. After removing the item, the internal consistency of the subscales was a Cronbach's $\alpha = .85$, acceptable to high.[41]

Questionnaire on the acceptance and use of technologies—telemedical psychotherapy (UTAUT). The questionnaire on the acceptance and use of technology in relation to telemedical psychotherapy was developed and translated into German based on the Unified Theory of Acceptance and Use of Technology Questionnaire.[42] It comprises a total of 21 items, which are divided into 5 subscales: Performance Expectancy, Effort Expectancy, Social Influence, Supportive Conditions, Intention to Use. With the help of a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), the acceptance of and trust in technical devices as well as the respondents' future intention to use them were surveyed. The internal consistency of the subscales was a Cronbach's $\alpha = .89$.

In addition, the participants were asked to answer two additional questions about their previous experience with video-based psychotherapy and their experience with telemedical interventions. Sociodemographic data was taken from the medical history questionnaire of the University Hospital of Tübingen and the baseline diagnostics (t0).

At the end of the therapy phase (t1) of the SSTeP-KiZ study, a total of five digital focus groups were conducted, each with two groups with adolescent participants, two groups with parents and one group with the study's team of therapists. All patients in the SSTeP-KiZ study were offered the opportunity to participate in the focus group discussions. A total of 21 people took part through a targeted sample, based on their experience of video-based psychotherapy. The focus group interviews were based on a semistructured interview guide, see Supplemental Appendix 2. The group interviews were conducted digitally via VidyoConnect® by an independent research assistant from Tübingen Hospital, who did not conduct any online therapies in the SSTeP-KiZ project and lasted approximately 60 minutes. Each focus group was introduced with a short presentation by the moderator on the topic of "video-based psychotherapy" and explained the aim of the group discussion. Afterwards, all participants were asked about their experiences with the online therapy they had already completed, and the advantages/disadvantages of the therapeutic online setting were concretized together. The participants were requested to discuss the limitations of video-based psychotherapy and modification ideas in relation to online interventions in psychotherapy.

Sample size and study population

A total of 20 adolescents aged 12 to 18 years (45% male), with an average age of 15.7 years (SD ± 1.78) took part in the SSTeP-KiZ study and the pre–post survey on technology affinity and technology acceptance. All participants in the SSTeP-KiZ study were included in the surveys on technology affinity and acceptance. The sample size was chosen based on a previously conducted pilot study and other face-to-face psychotherapy studies of the working group.[9,10,23] Further information on the sample size can be found in the paper by Klein et al. of the SSTeP-KiZ main study.[6]

In the two digital focus group interviews with adolescent participants, each with four people (50% and 100% female), the average age was 16 years (SD ± 0.81) and 16.75 years (SD ± 2.21). All subjects ($n = 20$) were offered the opportunity to take part in the focus group; only eight subjects decided not to participate. The reasons why adolescents decided not to occur in the interviews were not documented. Four and 5 parents (75% and 40% female) with an average age of 51.75 years (SD ± 4.03) and 45.6 years (SD ± 5.59), respectively, took part in the parent focus groups. The 4 participants in the therapist focus group (75% female) were licensed psychotherapists with an average age of 35.25 years (SD ± 4.5), all of whom worked in the SSTeP-KiZ project team.

Data analysis

The statistical analysis of the quantitative data was carried out using RStudio software.[43] The data was analyzed using descriptive statistics and frequencies for categorical variables, means, and standard deviations were generated.

The changes in the pre–post comparison and mean comparisons were calculated using t-tests. Spearman correlation analyses and regression tests were used to calculate potential moderators, such as the age or gender of the test subjects. As a measure of the effect size, Cohen's d was used, with a small effect starting at 0.2, a medium effect at 0.5, and a strong effect at 0.8.[44]

Results

Quantitative assessments

The technical affinity of the participants ($n = 20$) was 2.9 to 4.6 (mean 3.76, SD ± 0.48; boys mean 3.75, SD ± 0.47; girls mean 3.77, SD ± 0.51). Gender-specific norm values can only be used for adults (>18 years) to interpret the technology affinity values resulting from the TA-EG. Women have a low affinity for technology from a value of mean 3.39 (SD ± 0.56) and a high affinity for technology from mean 3.52 (SD ± 0.52). Among men, technical affinity is low at mean 3.59 (SD ± 0.59) and high at mean 3.71 (SD ± 0.53).[40] The results of the t-tests showed that the affinity for technology of the test subjects did not differ significantly within the gender groups $t(16.5) = -0.09$, $p = .93$. There were also no significant differences with regard to age $r(18) = -0.37$, $p = .11$.

Technology acceptance, measured by the future intention to use technologies, ranged from 3.6 to 7.0 (mean 5.60, SD ± 0.94). There are no standardized values for the interpretation of the results from the UTAUT questionnaire. Based on the 7-point Likert scale we used, mean values from a value of 5.5, above the 75th percentile, can indicate a high level of acceptance. Boys (mean 6.11, SD ± 0.36) and girls (mean 4.97, SD ± 1.06) differed significantly with regard to their technology acceptance $t(9.5) = 3.09$, $p = 0.01$, $d = 1.51$. However, the age of the patients had no influence on technology acceptance $r(18) = 0.24$, $p = .30$.

In the pre–post comparison of the participants' affinity for technology, calculated using a t-test with repeated measures, there was no significant increase in affinity for technology $t(19) = 0.08$, $p = 0.93$ or in acceptance of technology $t(19) = 1.00$, $p = .33$ as a result of video-based psychotherapy.

Focus group interviews

The data from the focus group interviews was recorded via audio file, transcribed according to Kuckartz et al. and then analyzed using structured qualitative content analysis.[45,46] The coding scheme consisted of a combination of a deductive approach, resulting from the interview guide, and an inductive approach, based on the content of the audio material. The analysis was carried out using the MAXQDA 2022 program.[47] All codes, including the subcodes, can be found in Supplemental Appendix 3.

A total of 11 main categories were identified in the focus groups: (1) previous experience with digital interventions in the health sector, (2) initial thoughts and feelings about video-based psychotherapy, (3) to what extent parents would also do their own therapy with sensor technology, (4) report experience to friends, (5) feedback on the sensor-based therapy approach combined with advantages and disadvantages of online therapy, (6) limitations of online therapy, (7) use and handling of the therapy app, (8) experience report to other therapists, (9) implementation and content of the therapy materials, (10) future use and related modification ideas, and (11) ideas for doctor visits in 2050. In the following section, only 4 of the 11 main categories of the focus groups are presented, as these provide specific information on the acceptance of an online therapy approach with sensor technology by patients, parents, and therapists. Categories* (2), (4), (5), and (7) are presented, the remaining content analysis data can be found in Supplemental Appendix 4.

Topic (2): Initial thoughts and feelings about video-based psychotherapy

Some of the adolescent participants were "*skeptical*" (Ado, m, group I, pos. 37) about the video-based form of therapy and were "*uncertain*" (Ado, f, group I, pos. 41). Some of them were positively surprised, as it "*worked better than I thought*" (Ado, f, group II, pos. 20). The therapists were also concerned at the beginning of the study and felt "*strange*" (Ther, f, group I, pos. 17) as regards working with the therapy setting via the Internet. "*Is that really possible via the Internet, and how is that supposed to work?*" (Ther, f, group I, pos. 18). However, most patients and families showed a positive attitude toward video-based therapy with sensor technology right from the start. They perceived participating in the study as a "*blessing*" (Par, f, group II, pos. 27), were "*happy*" (Par, f, group II, pos. 30) about the immediate possibility of treatment and consideration and thought it was "*fantastic that you can use this technology in this way*" (Par, m, group I, pos. 64). In the focus groups, there was a consensus on the lack of therapy options. "*The problem was that we couldn't find anything nearby that would have been suitable*." (Par, f, group II, pos. 27) and trained specialists "*it was totally difficult to find anyone at all. Most importantly, we don't actually provide compulsory therapy anyway*" (Par, f, group I, pos. 23).

Topic (4): Experience report to friends

Participants would describe the SSTeP-KiZ study as "*interesting*" (Ado, m, group I, pos. 60), "*definitely something different from what you normally know, not only because it is online, but also because of all this technology*" (Ado, f, group I, pos. 64), "*special*" (Ado, m, group I, pos. 62), "*practicable*" (Par, m, group II, pos. 46), and "*helpful*" (Ado, f, group II, pos. 60), which they would recommend to family or friends without restriction. "*I have already recommended you to others*" (Par, f, group I, pos. 92). The families perceived the "*on-site*" setting (Par, f, group I, pos. 72) in which the therapy took place as particularly beneficial. And described the form of therapy as a "*more effective method*" (Ado, m, group I, pos. 66) of treatment, where you can "*only benefit*" (Ado, f, group II, pos. 47).

Topic (5): Feedback on online therapy with sensor technology combined with advantages and disadvantages of online therapy

Advantages of online therapy. The parents saw the form of therapy as a "*lasting success*" (Par, f, group I, pos. 171) and generally mentioned far more advantages than disadvantages in the video setting. The advantages from the respondents' point of view were a clear "*saving of appointments and time*" (Par, m, group II, pos. 34), because "*you can integrate it well into the day*" (Ado, f, group II, pos. 54), a high level of "*flexibility*" (Ado, m, group I, pos. 79) with regard to appointments, shortened journeys "*it's great, that you don't have to drive anywhere anymore*" (Ado, f, group I, pos. 41) and targeted treatment through direct

confrontation in the places where the compulsions occur "*And then you can also practice the things where they take place*" (Ado, f, group II, pos. 78). "*The main problem was at home. And I thought that was very, very good, that you could really get to the heart of the problem.*" (Par, m, group II, pos. 43). The adolescents cited their own home as the main advantage compared to face-to-face therapy, as they "*felt safer (…) because you are at home*" (Ado, m, group I, pos. 134). "*With video therapy, it's just really cool because I was in my room and just felt comfortable.*" (Ado, f, group II, pos. 70). The personal distance makes it "*easier to tell things in person, because it might be a bit impersonal in front of the computer*" (Ado, f, group II, pos. 115) and "*to get over yourself*" (Ado, f, group II, pos. 142). According to the interviewees, the digital therapy setting offers "*indirect therapy that has made access possible for the general public, for everyone, regardless of location.*" (Par, f, group II, pos. 96). The inclusion of parents in the therapy sessions was also possible without any problems due to the therapy format. "*I found it very, very valuable that they also had the opportunity to come to the sessions and do exercises together.*" (Ther, f, pos. 24).

Advantages of sensor-based therapy. The advantage of the sensor technology was the digital recording of the "*vital parameters*" (Ther, f, pos. 37) and the live transmission to the therapist in real time. With a chest strap, the "*tension*" (Ado, f, group I, pos. 70) of the patients could be recorded "*simply more accurately*" (Ado, m, group I, pos. 81), so that "*targeted guidance during the exposure*" (Ther, f, pos. 38) was also possible through "*the eye-tracking glasses*" (Ther, f, pos. 22). This was a "*clear advantage over face-to-face therapies*" (Ther, f, pos. 37), as the "*therapist was also able to draw conclusions during the therapy sessions*" (Par, f, group I, pos. 49) and "*provide appropriate feedback*" (Par, f, group II, pos. 40).

Disadvantages of online therapy. As a disadvantage of the video-based form of therapy, the participants stated that a stable internet connection with sufficient "*wifi quality*" (Ther, f, pos. 59) and a guarantee of "*data protection*" (Par, m, group II, pos. 38) are basic requirements, otherwise "*you reach your limits if the internet doesn't break down*" (Par, f, group I, pos. 99). The interviewees described that "*face-to-face contact*" (Par, m, group II, pos. 103) in conjunction with "*getting to know the therapist personally*" (Par, m, group II, pos. 124) is very important for the young people and parents in the SSTeP-KiZ study. As ideas for implementation, the participants mentioned "*an introductory meeting*" (Ado, f, group II, pos. 193), an "*initial contact, in person*" (Par, m, group II, pos. 97), "*perhaps a face-to-face meeting, especially at the beginning, simply to build up a relationship*" (Ado, m, group I, pos. 122) or a kind of blended treatment. "*So, a few meetings first, maybe a 7th or 14th or something like that.*" (Ado, m, group I, pos. 126). In this way, "*trust could be strengthened to a certain extent in advance.*" (Par, m, group II, pos. 97). Some adolescents described that it was initially "*more difficult*" (Ado, f, group I, pos. 186) for them to open up via video and that "*building a relationship*" (Par, f, group I, pos. 99) was made more difficult by the digital format and possibly "*not all emotions are 100% perceptible via video the internet*" (Ado, f, group II, pos. 84).

The focus group participants expressed the wish for "*home visits*" (Par, m, group I, pos. 130), "*then you could theoretically show everything where you have the restrictions.*" (Ado, f, group II, pos. 101). The parents would like to have a "*relatives' group*" (Par, f, group I, pos. 83) to exchange ideas, a larger number of therapy sessions in the SSTeP-KiZ study. "*A few more sessions might not hurt.*" (Par, m, group II, pos. 74), so that the duration of the study is extended, and the treatment success stabilizes "*with a certain distance and also over a longer period of time*" (Par, f, group I, pos. 83), also in the form of "*buffer sessions*" (Par, f, group II, pos. 84), which can be used if necessary.

Disadvantages of sensor-based therapy. As disadvantages of the sensor-based form of therapy, the participants described that there were often "*technical problems*" (Ado, f, group II, pos. 54), "*the sensor system didn't work*" (Par, f, group II, pos. 71), "*the glasses (…) didn't record a few times*" (Par, m, group II, pos. 90), or "*my therapist couldn't see what I saw*" (Ado, f, group II, pos. 203) because the live transmission didn't work. Regarding wearing eye-tracking glasses, the young people stated that they found them "*a bit uncomfortable*" (Ado, f, group II, pos. 54) and "*a bit annoying*" (Ado, m, group I, pos. 97). At the beginning, they felt "*observed*" (Ado, f, group I, pos. 95) and could not live out their "*compulsions so blatantly*" (Ado, m, group I, pos. 98). In addition, with this form of therapy you are tied to your home and cannot leave the house "*without anyone noticing that an exercise is taking place.*" (Ther, f, pos. 62).

The therapeutic work on two screens to display the video section in an appropriate size and the program that displayed the various parameters of the sensors worn by the patient was experienced by the therapists as "*much more stressful*" (Ther, f, pos. 22) and "*suddenly very close*" (Ther, f, pos. 22) due to the eye-tracking glasses.

Topic (7): Use and handling of the therapy app

The digital assessment of the SSTeP-KiZ study was rated as "*simple*" (Par, m, group II, pos. 151), "*quick*" (Ado, f, group II, pos. 148), "*efficient*" (Ado, f, group I, pos. 262), "*time-saving*" (Ado, f, group I, pos. 215), "*useful*" (Ado, f, group II, pos. 144), and "*also really well structured*" (Ado, m, group I, pos. 268; Ado, m, group II, pos. 134). Some parents would have liked free text fields in which they "*could have added a few more words*" (Par, f, group I, pos. 165). The gamification section in the app was described as "*cute*"

(Ado, f, group II, pos. 156) and "*pretty cool*" (Ado, f, group II, pos. 150), which the young people felt "*should appeal to younger people*" (Ado, f, group II, pos. 156). From the participants' point of view, a comprehensive digital application in which all materials required for therapy can be stored would be useful in the future. "*If it was just one thing. That might be easier.*" (Ado, f, group II, pos. 199). This should include a "*diary*" (Ado, f, group II, pos. 199), a "*weekly plan*" (Ado, f, group II, pos. 199), a kind of to-do list to tick off, on which you can "*always write down or tick off like this*" (Ado, f, group, pos. 162), a "*reminder function*" (Ado, f, group II, pos. 160) with "*push-up messages*" (Ado, f, group II, pos. 158), a "*exercise diary*" (Ther, m, pos. 99) and an "*emergency button*" (Ther, f, pos. 86) for crises, a "*chat forum*" (Ado, f, group II, pos. 199) for contacting the therapist and a "*specially developed game with perhaps even some kind of therapeutic content*" (Ther, f, pos. 86) that is "*age-specific*" (Ther, f, pos. 94) with an "*even greater reward factor*" (Ther, f, pos. 86).

Discussion

The aim of this study was to get a deeper understanding of the experiences of patients who have participated in video-based psychotherapy with sensor technology and to talk to users and participating families of the SSTeP-KiZ study about their experiences with the sensor system, teletherapy and related modification ideas. And to investigate personal factors such as affinity and acceptance of technology in sensor-based psychotherapy.

The analysis of characteristics such as age and gender of the patients showed that these characteristics had no influence on the affinity for and acceptance of technology among the study participants. Fortunately, it was found that adolescents of both genders benefited almost identically from the video-based form of psychotherapy. The sometimes-prevailing hypothesis that adolescents with a male gender tend to have a higher affinity for technology than girls could not be confirmed in our study.[48,49] However, it did show that male participants stated that they generally accept technology to a greater extent than girls. However, regardless of gender, the extent of technology acceptance neither positively nor negatively influenced the treatment. On the other hand, acceptance has not increased because of sensor-based psychotherapy.

The adolescent participants and parents who took part in the focus groups of the SSTeP-KiZ study showed an overall high level of satisfaction with the sensor-based form of therapy. In the group discussions, all participants stated that they would recommend video-based treatment with sensor technology to friends or family friends with similar "problems." Acceptance among the participants was high overall. Adolescents appear to have a positive attitude toward vCBT interventions in psychotherapy and are very satisfied after using them.[29,50,51] There are currently only a small number of studies on the use of sensor technology in psychotherapy with children and adolescents. This study makes an important contribution to expanding the database in this area.[52] Results on the acceptance of comparable psychotherapy with sensor technology are lacking.

Most participants liked the digital form of treatment via video and found it pleasant and practical. However, participants also preferred temporary personal contact or pure face-to-face treatment. This is compatible with the findings of Lenhart et al. who also conducted video-based psychotherapy with adolescents with OCD and surveyed satisfaction with the digital form of treatment afterwards.[53] In retrospect, adolescents and parents would like to see a modification to the process of getting to know the future therapist. There was no personal contact with the therapist before the start of treatment—this is what the adolescents would like to see in a continuation or new study. For future video-based therapy methods, getting to know the therapist in person in the real world rather than in the digital world seems relevant from the users' point of view to be able to trust the therapist more quickly. This is because the therapeutic alliance between patient and therapist also appears to play a central role in terms of the effectiveness of therapy in video-based psychotherapy.[54] A kind of reminder function for the adolescents to use the web application of the digital assessment would be particularly desirable; this corresponds to the findings of Geirhos et al., who also chose a participatory research approach in the evaluation of a mobile-based cognitive behavioral therapy intervention for chronically ill adolescents.[55] The technical sensor system and the interaction of the different sensors also appear to be expandable for the adolescent users, as there were temporary failures of individual systems or compatibility problems.

Strengths

The strength of the present study is the insight into the subjective experiences of adolescents and families after participating in and conducting sensor-based psychotherapy. The group discussions made it possible to evaluate the innovative therapy approach with the developed sensor system with the first users and to critically discuss the topic of E-mental health interventions in psychotherapy from the perspective of the intervention group. With the help of this participatory approach, relevant information from the patients could be reported back to the study team so that the pilot sensor system can be modified on this basis. The subjective assessment of patients is enormously relevant for the further development of digital interventions in healthcare but is difficult to collect due to limited field access to patients. Based on the qualitative findings, this study can make an important contribution to acceptance research in sensor-based psychotherapy for adolescents with obsessive-compulsive disorder.

Limitation

The study has several limitations. We chose a participatory research approach for the focus groups, in which the sensor system was discussed by the users who participated in the feasibility study. All participants in the group interviews were patients, family members or study team members, so the results resulting from the focus groups must be considered in their context, as the patients and families had previously received free and timely treatment for their OCD. Possible social desirability cannot be ruled out in the focus group responses.[56] The sample of the focus group with the adolescents ($n = 8$) consisted of only a small part of the total sample of the SSTeP-KiZ study ($n = 20$). As the reasons for refusal and consequently nonparticipation in one of the two focus groups were not systematically collected, a slightly biased/selected sample must be assumed, and the results of the qualitative content analysis must be considered in the context of the possibly biased sample.

Due to the small sample of young people ($n = 20$) and a population of $n = 40$, the characteristics of the population cannot be adequately reflected, meaning that representativeness and generalizability may not be fully ensured. With the small sample, values from outliers or incorrect measurements can lead to distorted results, which can also influence the statistical power. Overall, it was found that the statistical power was too small due to the small sample, meaning that no significant differences between the groups or correlations between the variables could be found. The population studied is a slightly biased sample, as only patients with OCD and an interest in sensor-based therapy were included in the study and the focus groups were conducted with an even smaller selective sample.[57] As a result, the variables examined, such as affinity for technology and acceptance of technology, may already have been high or higher than those of the same age prior to inclusion in the study, as interest in a digital therapy method already requires an interest in technology and a certain affinity.

Conclusion

The sensor system used should be adapted based on the results of the qualitative survey so that it meets the needs of users even better and promotes treatment compliance. However, the results of the quantitative survey on technology affinity and acceptance should only be interpreted with caution in view of the small sample size. It seems necessary to evaluate the benefits of sensor technology in therapy and the associated increase in knowledge. And then to conduct randomized controlled trial studies to prove the effectiveness of the sensor-based therapy approach. Further participatory research involving patients on video-based psychotherapy interventions also appears to be enormously relevant to be able to adapt the interventions to the specific needs of patients. It would be highly welcome if the evaluation of such innovative therapy approaches would also evaluate topics such as acceptance and usability from the user's perspective as standard.

Abbreviations

ADHD	Attention Deficit Hyperactivity Disorder
Ado	Adolescents
CBT	Cognitive behavioral therapy
COREQ	Consolidated Criteria for Reporting Qualitative Research
ECG	Electrocardiogram
F	Female
HRV	Heart rate variability
IMIs	Internet and mobile-based interventions
iCBT	Internet-based cognitive behavioral therapy
M	Male
OCD	Obsessive-compulsive disorder
Par	Parents
Patient UI	Patient user interface
Pos	Position
RCT	Randomized controlled trial
SSTeP-KiZ	Smart Sensor technology in Tele Psychotherapy for Children and Adolescents with OCD
TA-EG	Technology Affinity Questionnaire
Ther	Therapist
Therapist UI	Therapist user interface
UTAUT	Unified Theory of Acceptance and Use of Technology Questionnaire
vCBT	Cognitive behavioral therapy delivered via videoconferencing

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Guarantor

AC.

Dissemination of results

The study, including data collection and analysis, has been completed. We plan to use the results of this study to further develop video-based psychotherapy with sensor technology for children and adolescents with OCD and to integrate it into standard care in the long term, so that the psychotherapeutic care of mentally ill people in Germany is improved. All results will be presented and disseminated at local and international conferences.

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Statements and declarations

Ethical considerations

Positive ethics vote was provided by the Ethics Committee of the Medical Faculty of the University Hospital Tübingen in November 2021 and August 2022 (877/2020BO1).

Consent to participate

All participants have given their written consent to take part in the study. In the case of underage participants, the parents or guardians had to consent to participation.

Consent to publication

All participants in the study were informed in writing that the results would be published in anonymized form and gave their consent.

Author contributions/CRediT

AKA, AC, and TJR were involved in conceptualization; AKA, AP, CS, and KH in project collaboration; AKA, AP, and FS in data extraction; AKA and JK in analysis; AC and TJR in review/editing/supervision; and preparation of the original draft, which was critically revised by all authors. All authors read and approved the final manuscript.

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Conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

The datasets which were used and analyzed in the current study are available from the corresponding author upon request.

Supplemental material

Supplemental material for this article is available online.

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