

A Qualitative Study Exploring the Experience and Value of Flow Transcranial Direct Current Stimulation (tDCS) and Behaviour Therapy Training Software Used at Home for Community Mental Health Team (CMHT) Patients with Symptoms of Depression

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Abstract

Background: Flow FL-100 is a self-administered transcranial direct current stimulation (tDCS) device with evidence of effectiveness in treating symptoms of depression. The Flow intervention also provides access to software application delivered wellbeing behaviour therapy training. Flow was offered by a community mental health team (CMHT) to those who experienced depressive symptoms. Participants completed six weeks use of Flow. This study explored participants' experiences and views on feasibility, acceptability, useability, and value of Flow. **Methods:** A qualitative methodological approach was employed, involving in-depth semi-structured interviews. Interpretative Phenomenological Analysis (IPA) was applied. Out of a sample of 27 participants using Flow, 14 participants, seven females and seven males consented to be interviewed. The age range was 21 - 63 years ($M = 40.21$, $SD = 13.99$). **Results:** There was support for the feasibility, acceptability, useability and value of Flow. Most participants used Flow as per standard protocol and described a positive impact on depressive symptoms, mood, motivation, and functioning. **Conclusion:** Flow has been successfully integrated into a CMHT depression treatment. It is important to offer CMHT patients an evidenced-backed alternative to existing depression treatments (anti-depressant medication and psychotherapies). The results support the use of Flow as a treatment option for CMHT patients with symptoms of depression.

Keywords

Depression, Community Mental Health Team (CMHT), Transcranial Direct Current Stimulation (tDCS)

1. Introduction

Depression is responsible for 7.5% of all years lived with disability, and is ranked as the largest contributor to global disability (World Health Organization, 2017). In Great Britain (GB) around 1 in 6 (16%) experience depression (Office for National Statistics, 2022); however, in those with severe mental illness (SMI) such as schizophrenia, depression prevalence is 29% (Li et al., 2020). Depression symptoms can have a severe negative impact on quality of life (Lépine & Briley, 2011) and depression diagnosis is the most common determinant of deaths by suicide (Vigo et al., 2016).

Of those with SMI under the care of a community mental health team (CMHT) in the United Kingdom (UK), with a diagnosis of moderate or severe unipolar depression, around 50% have a comorbid psychiatric diagnosis; the vast majority are prescribed antidepressant medication, often in combination with other psychotropic medications (Paton et al., 2020). The most commonly prescribed individual antidepressants were mirtazapine (33%, usually in combination with another antidepressant), venlafaxine (25%) and sertraline (21%); patients with severe depression were more likely to be co-prescribed an antipsychotic medication, lithium, or to have received electroconvulsive therapy (ECT) (Paton et al., 2020). Access to psychotherapy for depression may also be provided by CMHT in alignment with NICE guidelines (NICE, 2022).

Transcranial direct current stimulation (tDCS) is non-invasive brain stimulation administered via a portable device that delivers weak electrical currents (0.5 - 2.5 mA) to the brain (Gryczuk et al., 2021), and is used to treat depression (Razza et al., 2020). Meta-analyses of randomised sham-controlled trial results show tDCS is associated with significant improvements in depressive symptoms, with higher rates of clinical response and remission relative to placebo sham stimulation (Mutz et al., 2018, 2019; Moffa et al., 2020). A systematic review and meta-analysis of 23 randomised controlled trials (RCTs) involving 1092 participants found that tDCS is modestly effective in treating depressive episodes, and clinically superior to sham (Razza et al., 2020). tDCS is a safe and effective standalone treatment or can be used in combination with other anti-depression treatments (Razza et al., 2020). Experts in a UK NICE “Medtech innovation briefing” advised that Flow tDCS could particularly benefit people whose symptoms have not improved with existing interventions, or who have side effects with antidepressants (NICE, 2023).

Having tDCS treatment is generally reported by patients as acceptable and is well-tolerated, with mild and transient physical sensations, which may include burning sensations (16.2%), skin redness (12.3%), scalp pain (10.1%), itching

(6.7%), and tingling (6.3%) (Chhabra et al., 2020). Interviews exploring the experiences and perceptions of tDCS to reduce weight gain for patients with schizophrenia found that all participants described tDCS use as uncomfortable, but that physical sensations only lasted for a short time; participants reported feeling happier and having improved relaxation, motivation, and concentration (Grycuk et al., 2021). Patients having tDCS for a binge eating disorder reported minor and transient physical sensations and side effects attributed to tDCS, but that tDCS was an acceptable treatment (Gordon et al., 2021).

Flow is a product that can be purchased by anyone over the age of 18; it is combined tDCS (delivered by Flow FL-100) and software app-based wellbeing behaviour training (training module titles include: physical exercise, nutrition, mindfulness, sleep, and choosing actions). In a case series study of Flow, reliable change index (RCI) improvements were reported in depressive symptoms in five out of seven patients with depression (Sobral et al., 2022). In a 24-participant open-label single-arm feasibility study, a significant improvement in depressive symptoms after 6 weeks of treatment was reported, which was maintained at 3 and 6 months, and most participants reported that Flow was acceptable and that they would recommend it to others (Woodham et al., 2022). Perceived effectiveness of how helpful tDCS sessions were for improving depressive symptoms was reported by participants on a seven-point scale from “very unhelpful” to “very helpful”. At 6 weeks and 6 months 30% found it “quite helpful”; at 6 weeks 40% found it “very helpful”; at 6 months 50% found it “very helpful”; and all participants reported it had been helpful to some extent (Woodham et al., 2022). Qualitative studies undertaken specifically on experience of Flow tDCS found most patients reported that Flow improved depression symptoms and is acceptable, and patients would recommend it to others (Rimmer et al., 2022, Griffiths et al., 2023).

There is currently no qualitative research into the impact of Flow for people experiencing depressive symptoms who are CMHT patients. This is the first study to explore the CMHT patient experience and value of using Flow through in-depth interviews. This study takes a qualitative approach to answer the question: “What is the experience (feasibility, acceptability and useability) and value of using Flow for CMHT patients with symptoms of depression?”.

2. Methods

2.1. Design

Participants were recruited from a post-marketing evaluation study employing an open-label patient cohort design with no control group. A qualitative approach was employed using semi-structured in-depth interviews with participants. The interview questions created were informed by relevant research literature and the aims of the study.

2.2. Ethical Approval

The study was approved by the NHS Trust from which patients were recruited.

Ethics committee name—Ideas Forum: reference IFFLOW2. All participants provided informed consent. The study was delivered in accordance with the Declaration of Helsinki.

2.3. Inclusion and Exclusion Criteria

The sample was recruited from people using CMHT within the United Kingdom's (UK) National Health Service (NHS). Participants were included if they were determined by CMHT staff to have symptoms of depression, were aged 18 or over, had the mental capacity to consent, provided informed consent, and had the ability to understand verbal and written English. Participants remained on any prescribed medication they were taking and continued any current psychological interventions.

Exclusion criteria comprised: epilepsy (or having a history of seizures), a defect in the neurocranium and/or an implant inside the skull, an active implanted medical device, a neurological condition, a history of hypomanic/manic episodes, and an open wound in the area of pad contact point on the forehead.

2.4. Participants

Fourteen participants were interviewed: seven males and seven females. All participants had used Flow for a period of at least six weeks. The age range of the participants was 21 - 63 years ($M = 40.21$, $SD = 13.99$). Ten (71.4%) were currently taking antidepressants, with 4 (28.6%) not taking any; 2 (14.3%) were having psychotherapy alongside Flow use, 12 (85.7%) were not; and 11 (78.6%) stuck to the protocol for using Flow (5 times a week for 3 weeks, then 3 times a week for 3 weeks [for some their psychiatrist increased to 5 times a week for the second three weeks]), whilst 3 (21.4%) did not follow this protocol precisely they still used it regularly over the six weeks. Ten (71.4%) were continuing to use Flow after the six week period, four did not (28.6%).

2.5. Setting

The intervention was offered through a CMHT and delivered at home by participants (under the care of CMHT) living in the community in a county in the UK. CMHTs deliver community-based mental health care for adults and older adults with severe mental health needs, as close to their home geographical area as possible (NHS England, 2023).

2.6. Intervention

Flow FL-100 is a Conformité Européenne (CE) marked Class IIa medical device for the treatment of major depressive disorder (MDD) and received U.S. Food and Drug Administration (FDA) “Breakthrough Device” designation in July 2022, indicating its potential to provide effective treatment. Flow can be purchased directly by anyone in the European Union and other European countries. It is available for purchase from the manufacturer’s website for £400. Flow has

been used by >16,000 users in UK/EU and is offered by >70 private healthcare institutions.

The Flow app incorporates instructions of uses, the wellbeing behaviour therapy training and is used to control the Bluetooth-connected Flow FL-100 tDCS headset via the user's smartphone; this limits how often the device can be used and for how long. In the treatment protocol, the participant remains awake and self-administers 5 sessions per week for the first 3 weeks and then 3 sessions per week for the following 3 weeks, receiving a maximum of 24 sessions, with a maximum of one 30-minute session per day. After the initial six-week period, participants can choose to self-administer up to 3 sessions per week for as long as they choose. This was Flow Neuroscience AB's standard protocol.

Flow treatment was concurrent with any current treatment, e.g., antidepressant medication, face-to-face psychotherapy, or any online psychotherapy. The anode was positioned over the left dorsolateral prefrontal cortex (DLPFC) (F3 on the international 10/20 EEG system) and the cathode over the right DLPFC (F4); stimulation is 2 mA for 30 min. Seven brief (around 20 minutes, pace of completion chosen by user) wellbeing behaviour therapy training sessions are available for users to optionally engage with via the app. These provide learning about the links between behaviour and wellbeing and how to take actions to improve wellbeing and reduce depressive symptoms. They are titled: "The basics", "Choosing your actions", "Mindfulness meditation", "Exercise for your brain", "The anti-depression diet", "Therapeutic sleep", and "Looking back and planning ahead".

Flow also provides depression symptom level tracking that enables users to monitor their progress/symptoms. This is done by the completion of the nine-question Montgomery-Åsberg Depression Rating Scale Self-report (MADRS-S) (Montgomery & Åsberg, 1979) via the user's smartphone prior to a tDCS session. Flow also provides an integrated platform for the patient's clinical team, with the ability to remotely monitor patients, derive insights, and customise protocols. Flow has comprehensive user training and support available via a dedicated website and support team email; participants were made aware of this.

2.7. Procedure

The project was undertaken from July 2023 to December 2023. Participants were identified as having symptoms of depression by CMHT staff. Participants were selected if they met inclusion/exclusion criteria. Staff provided participants with a participant information sheet, answered any questions and then asked if they would like to try using Flow for depression symptoms for 6 weeks. They were then given a Flow device and instructions booklet, staff explained how to use it, download the Flow app and access the Flow website for training and support.

Informed consent was sought and required before commencing Flow. Participants could withdraw consent or stop engagement with Flow at any point without the need to provide a reason. Following completion of the intervention

(6 - 8 week point), participants were asked if they would like to complete an in-depth interview. The reasons given for those who did not want to be interviewed included: having not used Flow, a delayed start or interruptions using Flow (so not completed the 6 weeks), feeling unable to participate in an interview, and not responding to the request. For those who agreed, the interviewer contacted the participant to arrange a time to complete the interview. The interviews were undertaken over the phone and were audio recorded using an encrypted audio-recorder. As soon as the interviews were transcribed and anonymised, the audio-recordings were deleted.

Following informed consent, demographic information (gender and date of birth) was extracted from clinical records containing routinely collected data.

2.8. Methodology and Analysis

A qualitative design employing Interpretative Phenomenological Analysis (IPA) (Smith et al., 2012) to facilitate an in-depth and detailed investigation into the experiences of the participants. IPA analytical framework takes a participant-centred approach (Pietkiewicz & Smith, 2014), with the lived experiences of the participants being understood through a process of interpretation (Smith et al., 2012). This approach enables participants to discuss their experiences in their terms, contexts and situations, allowing for an in-depth exploration, and a detailed nuanced analysis of particular instances (Smith et al., 2012) to understand “what personal and social experiences mean to the people who experience them” (Shaw, 2010: p. 178). The analysis is a double hermeneutic process—initially the participants make sense of their worlds, and the researchers analyse this.

Data analysis was guided by the six-stage framework suggested by Smith et al. (2012). This comprised: Stage 1, gaining familiarity by reading and rereading the transcripts, and noting linguistic, descriptive and conceptual notes on each interview to aid the development of emergent themes; Stage 2, identifying and clustering key concepts, perspectives and ideas together; Stage 3, the development of super-ordinate themes, which comprised key statements that detailed core features of the participants experiences embedded in their accounts; Stage 4, identifying across all the interviews the patterns, similarities and differences, and the formation of relationships between themes, through cross-case analysis; Stage 5, the development of a master table following organisation of super-ordinate themes and the development of the subordinate themes, identifying the evidence that represent these; and Stage 6, development of a coherent and aligned account of the experiences of the participants. The analysis was iterative as there was a constant movement between subordinate themes and the super-ordinate themes. Data were assessed and checked continually to ensure that the themes were grounded in the participants' data (Smith et al., 2012).

Robustness and validation were assured through reflexivity and confirmation by three co-authors (contributing their mental health research and lived expe-

rienced of depression knowledge), and who maintained discussions on the procedures being taken and the development of the themes; agreements were noted and developed, and disagreements resolved through further discussions and reworking, rewording and refocusing of the themes.

3. Results

Two superordinate themes and 11 subordinate themes were developed. **Figure 1** presents all of the themes. Superordinate theme one refers to how the participants experienced using Flow, whereas the second superordinate theme is about the resulting impact that they perceived they experienced while using Flow. To maintain anonymity, all participants have been given a pseudonym.

Components that influence my user-experience of Flow

This super-ordinate theme captures the participant's experience of Flow, and how it is incorporated into their lives: how they use Flow, what promotes use and what may potentially be a barrier to use.

A user-friendly device, simple and easy to operate

All participants stated the CMHTs process of providing information about and offering Flow was appropriate and effective. Across all the narratives, Flow and its software app training was identified as easy to use. There were no issues found in physically putting it on, starting it, functionality, or using the training



Figure 1. Superordinate themes and associated subordinate themes.

app. Participants stated: “easy”; “convenient”; “clear”; “simple”; and “straightforward”.

Henry: *But it's so easy to use. I think that's the key bit. I'm a bit of a technophobe, so am not awfully good with stuff like that, but it's very easy to use...it's almost idiot proof...now, it's just like second nature.*

Charlotte: *I think it was self-explanatory, I was given enough information, and it was easy enough to pick up Flow...the app was quite easy, and user-friendly to use.*

Lucy: *Very straightforward. Download the app, get the headset working.*

Mindset: willing and open, nothing to lose

Participants were willing, wanting, and needing to try an alternative treatment. Lucy expressed how she was “willing to try anything”, Giles spoke about being at the point where “I'd literally accept anything”, and William expressed he had “nothing to lose”, Robert had run out of options: “I haven't got any other option. There's...nothing else”.

Emma explains how for her, while apprehensive, she was at the point of desperation, particularly given medication was to her no longer an option:

Emma: *Apprehensive at first because, but then also, for me, it was a bit of a last chance saloon, because I've been on multiple medications throughout my life, all of which either have not worked or worked [but had] side effects, so I was apprehensive but also willing to try.*

Active agent, taking control of own treatment

By using Flow participants felt they were active (taking ownership and responsibility) in their recovery, managing, and treating their mental illness:

Oliver: *I'm trying a new thing I've actively gone out of my way to get treatment...is inherently making me feel better about myself.*

That they were proactively involved in, and in control of addressing mental illness:

Henry: *You're doing something else proactively to help your condition, you're actually out there and doing something. I think it helps you to feel like you're more in control of sorting out your condition.*

Others were empowered and able to shape their own progress and see the results of this:

Calum: *You're empowered, to take steps in the right direction..., like have that kind of self-control and self-determination with it and being able to see and measure that impact over time.*

Fits into my personal routine, flexible and convenient

Participants discussed how Flow fitted into their lifestyles and priorities. For example, Calum found it was flexible for him around his work patterns:

Giles: *I used it around my shifts. It all depended on when I had my shifts, because I worked predominantly at nights, I was trying to leave a little bit of time between when I woke up and going to work.*

Convenience, flexibility and regular use were also important:

Henry: *I wanted to do it kind of regimentally, so I knew when I'd be doing it. And that was always around teatime, six o'clock in the evening.*

Jane: *I can choose when I use it. It's certainly different to going to (mental health clinical) appointments, it is easier to use.*

Lucy: *It was a routine, and not being in a routine becomes a challenge for me. So that was a positive for me. This is something that I do every day. So that was helpful.*

"Uncomfortable" (but not inhibitory) sensations using Flow

Participants discussed how they experienced some physical sensations when using Flow that were perceived to be uncomfortable and unpleasant. The language used to describe this included, "*itchy burn*", "*burning sensation*" [William, Ellie]; "*tingling*" [Oliver, Henry, Emma, Jane, James]; "*pin pricking*" [Katherine, Henry]; "*itchy and like hot*" [Charlotte]; "*stingy*" [Emma, Sally, Jane]; "*like stinging nettles*" [Robert]. The important factor was that although deemed uncomfortable/unpleasant it did not stop participants from using Flow regularly. As Emma noted, it was not "unbearable":

Emma: *Tingly, sometimes stingy sensation, but nothing unbearable... I did get like dry patches on my head as well. But nothing unbearable, or that prevented me from using it.*

For some these sensations provided validation and confirmation that Flow was working:

Oliver: *Actually, if it's like tingling properly, I use an indicator that I have actually got it in a place where it's getting enough surface area.*

Only two participants reported any negative side effects, one reported a temporary headache for the first three times, which was relieved by taking paracetamol, and one temporary dizziness after using which resolved quickly on its own, neither prevented use of Flow.

Individual obstacles interfere with engagement

For some of those who did the training they could not recall anything they had read and had not applied any behaviour changes. Some participants were unable to engage with the behavioural training apps, for a variety of reasons. Related to neurodiversity Giles talked about his autism suggesting he would have benefitted from information being read out to him, as this is his preferable learning style, and the reading required excluded him from engaging. Oliver talks about his attention deficit hyperactivity disorder (ADHD), and uses the idiom "uphill struggle" to emphasise the difficulty he had engaging with the app:

Oliver: *I've been making my way through quite slowly, to be honest, I have*

ADHD, it very hard for me to sit down and concentrate.

Some participants simply felt unable at times to commit to using Flow. An example of this is Katherine who talked about external stresses (family, financial, and alcohol problems):

Katherine: But I have had a few missed sessions, because of because of external things that have been going on with me. Well, I haven't felt well, and I've just haven't done it, you know I just can't face it tonight...this is very stressful for me and takes me out of my normal routine of using Flow at times.

For Lucy, mental health problems prevented her from using Flow. She feels that she could have done with adjunctive psychotherapy which may have helped her engage with Flow. As she expresses, she is in a place where she is giving up on everything, and so this prevents her engaging with Flow.

Lucy: Had I had psychotherapy with Flow would have helped. I think I stopped because, I'm giving up on everything at the moment. I have been going through a bad patch the way I am feeling has stopped me using it.

Perceived impact and outcomes for me

This super-ordinate theme comprises five subordinate themes which link to participants' perceived impact and outcomes.

Offers a viable alternative to prior ineffective treatments

Several participants found that previous treatments have not worked for them, and Flow offers an alternative option.

Jane: I was running out of options. I've tried rTMS, counselling, medications, I just feel like I am coming to the end like of different things to try.

Participants reported a non-pharmacological alternative was an attractive option:

Henry: "So, the fact that I was offered something that was drug free, was appealing".

Katherine discusses how mental illness had been a long-term issue and how previous interventions haven't worked:

Katherine: I've suffered with mental health, for as long as I can remember, since childhood and looking back, I've been on so many different medications that have worked for a while, and then it's sort of back to square one again. So, anything I can have that will offer something different, a change that might be the one, is great.

Such despair is reiterated by Oliver, following no progress or success with both medication and talking therapies. What is clear in his narrative, and those of others, is the need for other treatment options:

Oliver: Basically, I was never particularly trepidatious about it, I was just

happy that was an extra option because I was getting really quite despaired about, for all that there is talking therapy and medication, neither of which had actually done anything for me.

Gaining new or recapitulating existing knowledge to support recovery

This relates to the behavioural training apps. Katherine was able to gain new knowledge that could be of benefit:

Katherine: I've found that training helpful, and I've gained new knowledge and information from the training... There are quite a few things on there, I didn't know that foods that can cause you to be down and lethargic. So that's been really interesting.

Giles indicated how, by gaining such new knowledge, he was able to use this to implement positive behaviour change:

Giles: It was a lot of stuff on the diet stuff that I didn't really know. I mean, I try to do some of it... I use a lot less processed foods... I eat a lot more nuts now. So, I have changed my behaviour.

For a proportion of the participants the training was a reminder of what they already knew to do to keep themselves well. The participants talked about being able to “*recap over*” [Jane], how it was “*reaffirming*” [Calum, Emma], a “*re-fresher*” [Giles]; or “*an overview of things that I'd already been taught*” [Sally].

Calum: And I found some of the insights from some of the modules interesting. There are golden nuggets like new knowledge on how [diet] impacts energy and with what your body needs. It's also really useful obviously reaffirming some of the sleep hygiene.

Improvements in symptoms of depression, a lift in mood

This subordinate theme is how participants perceive that their symptoms of depression have lessened or been removed, and they have experienced improvements in mood as a result of using Flow:

Giles: I think it's massively helped my symptoms of depression; I just wish it had been offered years ago. But I do feel slightly happier, motivated in mood and more relaxed. My colleagues have noticed I appear a bit happier at times.

Jane also believes Flow has made a positive impact for her:

Jane: Being able to cope with things a bit better. I felt like it's definitely lifted it [mood]. It definitely like works and definitely makes a difference to me and my outlook on life. It definitely worked better than I was expecting it to work.

Oliver articulates the difference he feels Flow has made:

Oliver: I just feel lighter, in general... I feel a lot more confident... I don't feel like I am so bogged down by my own brain. I feel less like the future is

like a black void that's never going to come about, I feel less worthless... I feel more genuinely happy about things.

Emma also clearly expresses the difference she feels Flow has made:

Emma: So, a massive difference, like three months ago I was suicidal, I just wasn't functioning as a person. I was having some periods of time off work. I was non communicative with my partner. I just, everything now just feels brighter, and I feel a lot more kind of present in life.

Some participants saw the value of time spent using Flow and training apps beyond the potential impact of tDCS:

Katherine: And I think it's like timeout, isn't it really? You've got to think about what, you know, you're doing the activity on the screen, the machines doing its thing, and really, you can't think of anything else. You're focused in that half an hour. So, I think that's really good.

Benefitting from "knock-on effects", a positive feedback loop

Participants suggest that through Flow lifting their depression they experienced knock-on or culminative effects. They were able to engage in things like a better diet, they had more energy, slept better, had more motivation, and they could enjoy engaging in activities (e.g., socialising, doing physical exercise), all of which in turn positively impacts on their depression. Henry explains how through his improved depression, socialising and interacting with others is possible and is enjoyable and beneficial. He makes the comparison how he has made the move from experiencing a vicious circle of being depressed, not socialising, and so no possibility of socialising relieving his depression, to a virtuous circle of improvements in his depression, so being able to interact and socialise, which in turn impacts positively on feelings of depression:

Henry: Feeling a bit more positive, I've recognised that actually interacting and socialising with people more, it's actually good for me. Again, with depression and anxiety it is you can tend to just keep yourself to yourself, the fact it's helped me to feel a bit more positive means you interact, and it's whatever the opposite of a vicious circle is. It just is part of a positive cycle...a virtuous circle.

Being energised by socially engaging, rediscovering sense of humour and being able to be themselves was beneficial for Emma:

Emma: Because now I feel like I've got my sense of humour back. I don't find it exhausting being around people anymore. Whereas now I can be myself.

For Oliver it is in relation to overeating. He describes how he has the "fight" to not overeat which then makes him feel better about himself, thereby meaning he does not feel so depressed.

Oliver: The reason I'm able to stop myself overeating now is because I feel

less depressed and feel more able to fight the constant urge to go just like eat every item in the house basically. I feel less like crap about myself, and I am not hugely overeating. It definitely is like a positive feedback loop.

Several participants mentioned sleeping better due to better mood and mental health, which was beneficial to them:

Emma: Now I will sleep all the way through and probably wake up at around about six in the morning. It really has made a difference. I just think because my moods lifted, like my brain is quieter. That was the issue before that I just couldn't switch off and relax.

Several participants discussed how the improvement in their depression meant they felt more motivated to do things. Emma, for example, talked about how she felt motivated to do things she enjoys, whereas before she was not and just wanted to stay in bed; Oliver talked about previously just sitting around doing nothing, but with improvements in depression he was motivated to do things he enjoyed, and this made him feel better. Likewise, Sally talks about this motivation, and describes “knock-on” effects which means she experiences this positive feedback loop described by other participants.

Sally: But I feel now that my motivation has got better, definitely more motivation. I am getting knock-on effects, I am more motivated and finding it easier to go out and socialise people that then has impacted my mental health positively because I'm feeling better for doing that.

Other participants also expressed such knock-on effects in relation to motivation, with Giles describing he had been motivated to do something he has been unable to do, and Lucy expressing how her lift in mood and resultant motivation enables her to engage with things she really likes, and this is now enjoyable:

Giles: I've got more motivation, and I'm less anxious. I've actually managed to get out on my own for the first time in three years...actually going out for a day out, which for me is amazing.

Lucy: That was the biggest thing I struggled with. I didn't have any motivation to do anything. And now I do. Because my mood is so much more lifted, it's like I want to go out and explore things and play instruments again. Everything just seems enjoyable again.

In addition, having better mental health and being more motivated led to setting and striving towards goals:

Henry: So, the goals in my life at the moment are to get back into working more. And it's, my Flow is a key part of that.

Calum: I think, yes...wanting to care more about yourself...one is to be more present for [my children]

It didn't work for me, no noticeable impact

For three participants, they experienced no noticeable difference using Flow.

This is expressed by Ellie, who felt no changes happened at all:

Ellie: I just felt like it didn't work for me, yes, they do like a chart of your moods over the week, and it stayed pretty much the same, it just didn't work for me, it made no difference. I didn't notice any improvement, no. Everything just stayed the same.

Charlotte really believed that this would be something that could work for her—she was open to this and was disappointed in not noticing a difference:

Charlotte: There's nothing at all that I can pick up that I think Flow helped me with or had impact on... I really believed it would. Even if it was a placebo, like I would get that. So, I was quite disappointed that no, I didn't notice anything.

Robert expressed that while Flow did not work, it at least it did not make things any worse:

Robert: I don't think Flow made me any worse. I just don't think it's made me any better.

4. Discussion

This study provides support for the acceptability, feasibility, useability, and value of Flow, evidencing that successful integration of Flow as part of CMHT patient's depression treatment can be achieved and can be beneficial. Findings suggest that patients in a CMHT (who often have an extensive history of depression and have tried various antidepressants and psychotherapies) were open, willing and want to try tDCS as an alternative treatment. Participants described a need to try an alternative, as other treatments have not worked, or they still have symptoms of depression.

Some participants indicated that side effects prevented use of anti-depressants and Flow offers them an alternative without these side effects. There are many CMHT patients who are on antidepressant medication. Some patients wish to stop using antidepressants, due to negative side effects, dependence, and wishing to have a “medication-free” life, but withdrawal can be problematic and depression symptoms may reoccur (Hengartner et al., 2020), highlighting the need for alternative treatments.

Participants found engagement with Flow was enabled through the useability of the device: it was easy to set up and use and could be embedded into their daily routine. This study's findings offered insights into physical sensations and side effects of Flow FL-100 delivered tDCS. The physical sensations reported aligned with those listed by Chhabra et al. (2020). The findings add to and align with previous evidence of acceptability and uncomfortable but temporary sensations and side effects reported by other qualitative tDCS studies (Gordon et al., 2021; Grycuk et al., 2021; Rimmer et al., 2022; Griffiths et al., 2023), these did not prevent the use of Flow FL100.

RCTs show the effectiveness of Flow on valid and reliable measures of depression (Mutz et al., 2018, 2019; Moffa et al., 2020; Razza et al., 2020). How this is achieved and participant's perceptions of the impact on depressive symptoms and their lives are important. A key element of mental health recovery (Leamy et al., 2011) reported by this study's participants, is that the use of Flow enabled participants to be active in their mental health recovery: taking ownership and responsibility in managing and treating their mental illness and in improving their wellbeing.

Many participants in this study reported improved depressive symptoms. The findings support evidence of perceived helpfulness of tDCS for improving depressive symptoms (Woodham et al., 2022; Griffiths et al., 2023). In this study there were reported improvements in mood, motivation, and sleep attributed to use of Flow. These factors translated into reported improvements in functioning such as socialising, having more energy to do activities, undertaking physical activities, and engaging in and enjoying activities; and this generated "a positive feedback loop"—further reducing depressive symptoms. This aligns with improved motivation to do activities reported by other qualitative tDCS studies (Gordon et al., 2021; Grycuk et al., 2021, Griffiths et al., 2023), and with the process of mental health recovery (Leamy et al., 2011).

Patients in CMHTs typically have severe mental illness and more than one a mental illness diagnosis, and they may need other treatments at the same time as Flow (psychotherapy and mental health medication) to enable them to be able to effectively engage with and use Flow. CMHT patients also tend to have more chaotic and stressful lives than the general population and, as reported in this study, external stresses can negatively impact on using Flow. This indicates the need to have extra support to address and cope with these factors to facilitate Flow treatment engagement, this support could be best delivered by peer support workers.

For some participants Flow wellbeing behaviour therapy training provided useful new knowledge and advice and facilitated positive behaviour changes. For others, the training was a reminder of what they already knew enables them to keep themselves well. This supports evidence that Flow combined tDCS and software app wellbeing behaviour training (physical exercise, nutrition, mindfulness, sleep, behaviour activation) is beneficial (Sobral et al., 2022; Woodham et al., 2022; Rimmer et al., 2022; Griffiths et al., 2023). Some participants did not use the training modules; autism, ADHD, and unwillingness to try prevented use. The training modules delivery could be adapted to make them more applicable to a variety of neurodivergent participants and learning styles.

Due to recruitment though an NHS CMHT in a single county of the UK, generalisability to other settings is reduced. However, CMHTs across the NHS operate under the same requirements and delivery models. Participants in this study self-selected, which can introduce bias, as more people with a positive experience may be willing to be interviewed and their experiences and perceptions

may differ from those who did not wish or felt unable to be interviewed. Fourteen is a sufficient number for a qualitative in-depth interview study as saturation often occurs at around twelve participants in relatively homogeneous groups (Guest et al., 2006).

5. Conclusion

The protocol to offer and provide Flow to CMHT patients with symptoms of depression was reported as working well by the participants. The majority of participants interviewed reported a beneficial effect on their depression symptoms, mood and motivation, with all reporting that physical sensations experienced did not prevent use. The improvement in depression symptoms, mood and motivation is significant for CMHT patients who have an extensive history of depression and who have found other treatments ineffective. However, some participants found no benefit from using Flow and it is important to provide support and further treatment options for those who do not respond. These findings provide support for the approach of offering tDCS and at the same time wellbeing behaviour therapy training for CMHT patients experiencing depression. Some people do not wish to try or do not respond to antidepressants or psychotherapy, so it is vital to offer an additional choice of an effective evidence-backed depression treatment that could work for them.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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