1. Introduction

1.1. Cognitive impairments in bipolar disorders

Bipolar spectrum disorders are worldly estimated to affect 29,5 millions of people, and are thought to be one of the tenth most disabling disorders worldwide (World Health Organization, 2008). Given the complexity and variety of bipolar symptoms, it's a common opinion today that pharmaceutical treatments can't suffice to ensure both patients' remission and recovery (Frank et al., 2000). Indeed, although nearly sixty percent of stabilized bipolar patients suffer from important cognitive impairments that lead to significant functional disabilities, cognitive deficits have been overlooked (Pattanayak et al., 2011). Until recently, diagnosing cognitive deficits had been complicated by the heterogeneity of bipolar disorders (Ferrier & Thompson, 2002; Tiihonen et al., 2005) and the numerous comorbidities patients suffer from (Goldberg & Chengappa, 2009; Olley et al., 2005).

Nowadays, controlled studies managed to reduce these biases and identify a profile of cognitive symptoms in bipolar disorders. Although we can't determine if cognitive deficits exist before the first episode, it is now commonly accepted that bipolar patients suffer from cognitive symptoms from the first acute episode (Harvey et al., 2010) and that without proper treatment these impairments remain throughout their lifespan (Pattanayak et al., 2011). This cognitive profile gathers "trait" deficits (i.e., cognitive impairments found even in euthymic states), as opposed to "state" deficits that are only present during acute episodes. Stabilized patients frequently suffer from impairments in executive functions (inhibition, planning, spatial reasoning), sustained and selective attention, psychomotor speed, verbal learning and memory, visual memory and cognitive flexibility (Bora et al., 2009; Cullen et al., 2016; Martínez-Arán et al., 2004; Olley et al., 2005; Sparding et al., 2015). The most important impairments are found in executive functions: a few studies even conclude that inhibition deficits could be an endophenotype of bipolar disorders (Bora et al., 2009) and that spatial reasoning deficits may be a major risk factor predicting the pathology (Tiihonen et al., 2005). Patients also suffer from impairments in social cognition and metacognition (Samamé et al., 2012; Wykes & Spaulding, 2011).

Although the neurodegenerative nature of cognitive impairments in bipolar disorder have recently been questioned (Samamé et al., 2014), many studies observed a progression of cognitive deficits - especially executive functions (Laes & Sponheim, 2006), verbal memory (Sánchez-Morla et al., 2009) and verbal learning (Peretti et al., 2004) - that seems to be correlated to a functional

decline in bipolar disorder (Goodwin et al., 2008). These impairments worsen the patient's handicap, curbing the efficiency of pharmaceutical and psychotherapeutic treatments (Latalova, et al., 2011). Many authors suggest that bipolar patients could benefit from a specific treatment for their cognitive deficits (e.g., Latalova et al., 2011; Vieta et al., 2013) such as cognitive remediation [CR], a therapeutic intervention that proved its efficacy on cognition, psychosocial functioning (McGurk et al., 2007) and neural processes (Isaac & Januel, 2016) in schizophrenia.

1.2. Cognitive remediation for bipolar disorders

CR is a therapeutic intervention consisting in an intensive training of cognitive functions during which the patient develops strategies to concentrate, memorize, process information and solve problems (Medalia & Choi, 2009). CR's objective is to improve quality of life and social rehabilitation through cognitive impairments' reduction (Dubeau et al., 2007). Its development in psychiatry was supported by patients and their caregivers, who wished treatments to focus more on cognitive impairments (Marder, 2008), owing to the fact that these deficits have a major influence on psychosocial functioning and quality of life (Penadés et al., 2010). A large number of CR programs exist, each one having its specificities in terms of duration, frequency, techniques and tools (Wykes & Spaulding, 2011). Despite CR's efficacy and its low cost for the health care system (Patel et al., 2010), CR programs struggle to become widespread in psychiatry.

Many authors suggest that CR therapy could benefit patients suffering from a bipolar disorder (e.g., Goodwin et al., 2008; Harvey et al., 2010; Levy & Manove, 2012). However, to our knowledge, a few number of studies investigated the effect of CR on cognitive functions for bipolar disorders. Deckersbach et al. (2010) conducted an open trial on 14 bipolar patients, where they observed the effect of 14 individual CR sessions targeting mood monitoring, executive functions, attention and memory. They found after therapy a subjective improvement in executive functioning and general psychosocial functioning, but did not objectify these results with neuropsychological measures. Interestingly, authors also observed a decrease in residual depressive symptoms after therapy. Isaac et al. (2013) realized a case study on a patient suffering from a bipolar disorder receiving 24 individual bi-weekly CR sessions and 12 weekly at-home sessions of CRT, a validated program for schizophrenia, largely used in psychiatry (Wykes & Reeder, 2005). Results on rater-administered scales and neuropsychological assessments further supported the hypothesis of a possible improvement of cognitive and functional abilities in bipolar disorder, with individual

cognitive training. These results however questioned the effect of the CRT program on several untargeted cognitive functions, such as working memory or visual and spatial memory; and on social cognition and metacognition. In a controlled study, other authors observed a significant improvement in executive functions after 24 computerized CR sessions over eight weeks (Preiss, et al., 2013), when compared to standard treatment, in a population of unipolar and bipolar patients suffering from depressive symptoms.

However, when the CR program was administered in group sessions, other studies failed to demonstrate an improvement on neurocognitive functions after CR when compared to a control treatment. A first randomized controlled clinical trial compared the effect of group CR to standard care. The CR program consisted in 13 weekly two-hour sessions, each of which containing psychoeducation, group exercises based on the CRT program, and computer-assisted cognitive training using the RehaCom software (Demant et al., 2013). The authors observed no significant effect on verbal memory, sustained attention or executive functions, and no significant improvement on patients' psychosocial functioning (Demant et al., 2015). In another randomized controlled trial, Torrent et al. (2013) failed to observe a significant effect on cognition or clinical variables of a functional remediation program when compared to psychoeducation or standard care, even if the program was designed for bipolar patients and addressed neurocognitive impairments along with everyday functioning. After 21 weekly 90-minutes group sessions, patients improved in verbal memory without any significant difference with either psychoeducation or standard treatement. Furthermore, in these two controlled trials, the effect of CR or functional remediation on cognition was not significant when compared to control treatment, even when observing only type I (Demant et al., 2015) or type II bipolar patients (Ibid.; Solé et al., 2015).

Currently, the limited number of clinical trials prevents from concluding on the effect of CR on cognitive impairments in bipolar disorders. However, individualized programs seem to benefit patients better than group CR. This can be explained by a more intensive training and by the adaptation of therapy to the specific impairment of each patient. Indeed, CR has proven its effectiveness in schizophrenia in including an average treatment intensity of 2.2 sessions per week (Wykes & Spaulding, 2011) a frequency hardly reachable with group therapy. Medalia and Richardson (2005) concluded that a frequency of two sessions per week or higher is a good predictor of response of CR. Furthermore, neurocognitive impairments seem to be heterogeneous in bipolar disorders (Baldessarini et al., 2012) and CR program for this population may need to be

more individualized to produce cognitive improvements (Demant et al., 2015). With the development of CR for patients suffering from a bipolar disorder, designing a program that treats the patient's specific impairments seems to be desirable and necessary.

2. Methods

2.1. The ECo program

We developed an individual CR therapy for patients suffering from a mood disorder. We created a program called Eco (program registered to the French company "Société des Gens de Lettres"), that uses paper and pen exercises and exercises with tools the patient can handle. This program is used as a medium to help the patient develop problem-solving strategies throughout therapy. ECo was designed to be used in a 28 one-hour sessions therapy (14 weeks, 2 sessions per week). Added to this therapy sessions are 14 "at home" sessions with exercises from the ECo program.

The ECo program is divided in five modules: 1. a psychoeducation module (two sessions); 2. a cognitive training module on attentional processes (eight sessions); 3. a cognitive training module on memory (eight sessions); 4. a cognitive training module on executive functions (eight sessions); 5. a functional module (two sessions). In each of the three cognitive training modules, four cognitive functions are trained. For each cognitive function, we propose five different exercises of about ten levels of growing difficulty each (cf. Table 1).

In the psychoeducation module, the patient and the clinician discuss about several dimensions such as cognitive functions, cognitive impairments and the risk factors that may influence them, or functional difficulties and their origin. This module also aims to better understand the goal of CR therapy and its complementarity with the pharmaceutical treatment and other ongoing therapies. We added psychoeducation before any cognitive training according to literature. Indeed, an order to increase the potential for a functional improvement after therapy, authors stated that CR would need to include psychoeducation about cognitive impairments (Martínez-Arán et al., 2011) as a way to improve metacognition (Vianin, 2007).

According to literature, people suffering from a bipolar disorder often experience less diffuse and homogeneous impairments than schizophrenic patients (Sánchez-Morla et al., 2009). A program for bipolar patients should then propose more complex exercises (Dekersbach et al., 2010) and

should allow the clinician to begin CR with the most impaired cognitive function or domain, in order to maintain patients' motivation throughout therapy (Medalia & Choi, 2009). The three cognitive training modules in ECo are used in an order defined by the clinician according to each patient's impairments as observed through neuropsychological assessment. An exercise begins with exploration levels designed to make the patient try different strategies and gradually choose the one(s) that are the most efficient for him. The following levels of the exercise are more complex. They are made to challenge the patient who then needs to use his strategies to succeed.

Furthermore, authors stated that CR for bipolar patients should focus on cognitive functions frequently impaired in bipolar disorders, such as visual and spatial reasoning (Tiihonen et al., 2005) and inhibition (Bora et al., 2009). ECo contain a sub-module for inhibition in the executive functions module. In this module, we also designed exercises to work specifically on visual and spatial reasoning. Furthermore, we emphasized these two dimensions across the program. A large number of exercises in the three modules need inhibition or visual reasoning strategies to be achieved. Furthermore, we designed exercises pages with numerous stimuli, so that the patient constantly needs to inhibit those he does not work.

Given the heterogeneous profile of bipolar patients, we designed a program where every cognitive function is trained, but where the therapist chooses which exercises to work on for each cognitive function, in order to help the patient with his specific impairments and goals for therapy. This is justified by the hypothesis that letting the clinician and the patient choose certain exercises that are both appealing and adaptable to the patient's life would increase the patient's motivation and self-efficacy (Wykes & Spaulding, 2011). To ensure that the patient can develop strategies in different contexts, we designed five different exercises for each sub-module that use different media (visual with letter, numbers or figures, verbal, tool) or different aspects of the cognitive function: for example, in the divided attention sub-module, some exercises train the ability to pay attention to several stimuli and other the ability to do several unconnected tasks at the same time.

Finally, according to authors, CR should propose exercises that are more contextualized, within an ecological design. This would help patients use strategies in real life and social situations in particular, by developing their social cognitive skills (Medalia & Choi, 2009; Wykes & Spaulding, 2011). ECo was designed as an ecologic program, with exercises built to train the patient in the first levels, then in the last levels to help him use efficient strategies in a context close to real life

situations. In the last levels of each exercise, the patient needs to apply learned strategies in a more practical context. These practical applications of the strategies can be used later in real life. We also created a fifth module that aims to help the patient try efficient strategies in real life situations. In the functional module, the patient and the clinician discuss about situations in his life that are difficult to deal with because of cognitive impairments. The patient needs to identify a problem, its consequences and the impact on his emotions and mood. Then, he is guided to identify the cognitive functions involved in this situation and the possible strategies he can use to solve the problem. Finally, the patient tries these strategies at home and discusses them with the clinician during the next therapy session. This last module help the patient understand that a difficult situation can be dealt with when using the right strategy. Patients are encouraged to continue using this method later in life when they meet other difficult situations, after the end of the therapy.

A summary of the advances of ECo, based on the conclusions of several studies, is presented in table 2.

2.2. Pre-validation of the program

We proceeded to a content pre-validation of the ECo program on healthy volunteers. The sample was made of 35 people who had the understanding of cognitive functioning (at least in third year of psychology studies). Volunteers received a 30 minutes presentation of cognitive remediation to ensure that they understood the aim of this therapeutic intervention. Volunteers were shown exercises from the program and were asked to try to do them. They were then asked to fill out an anonymous questionnaire where they wrote their impression on the exercise's growing difficulty at each level and rated the exercise's interest and attractiveness on a numeric rating scale from 0 to 10. Volunteers rated an average (SD) of 8.4 (0.53) for interest and 7.6 (0.78) for attractiveness. There were no difference between the modules for interest and attractiveness ratings. The less interesting or less appealing exercises were then adjusted for their content or format.

3. Case study

3.1. Patient

Mister F., a 62 years old patient suffering from a type II bipolar disorder, received 28 cognitive remediation sessions starting on May 2014. The patient went through three hospitalizations for Major depressive disorders. His first hospitalization was in 2005 and he received his diagnosis in

2008, after experiencing a three-week hypomanic episode. Mister F. was an agricultural engineer, he is retired since 2012. He has a daughter and is currently in a relationship, but he lives alone. The patient is involved in several voluntary associative activities and attends to scientific lectures. During his spare time, he likes reading and writing. Before therapy, the patient's main cognitive complaints were: 1.reasoning (putting ideas together and understanding what he is told); 2.selective attention (focusing on an activity or a thought; reading when there is noise around); 3.visuo-spatial and verbal memory (finding personal effects; remembering names); 4.planning (organizing different activities during the same day). These difficulties hindered him from actively participating in associative work and lectures and led to a significant reduction in his everyday life activities and social interactions.

3.2. Assessments

Before and after therapy, the patient received a thorough clinical and cognitive assessment and completed self-assessments. All assessments were conducted and scored by trained psychologists and psychiatrists. Our main outcome was the Perceptual Reasoning Index Score of the Wechsler Adult Intelligence Scale – Fourth Edition [WAIS-IV], since this index score assesses cognitive functions frequently impaired in bipolar disorders (Tiihonen et al., 2005). Other neuropsychological assessment consisted in the Rey Auditory Verbal Learning Test [RAVLT], Verbal Fluency, the Stroop Color Word Test [SCWT], the Key Search Test (from the Behavioral Assessment of the Dysexecutive Syndrome), and the Emotion Hexagon assessment (from the Facial Expression of Emotion: Stimuli and Test). Clinical assessments of mood and functioning were conducted with the Hamilton Depression Rating Scale, 17 items [HAMD-17], the Young Mania Rating Scale [YMRS] and a French questionnaire for the Assessment of Functional Repercussions [AFR]. Self-assessments consisted in the Short Form Health Survey, 36 items [SF-36], the Social Desirability Scale [SDS] and the Self-Appraisal of Illness Questionnaire [SAIQ].

3.3. Results

Cognitive and clinical results are presented respectively in table 3 and 4. At baseline, cognitive assessments suggest major executive functions impairments (visual and verbal abstraction, spatial reasoning, inhibition, planning), moderated impairments in verbal memory, processing speed and attentional processes, and preserved abilities in working memory, verbal comprehension and

emotion recognition. These cognitive results are in accordance with the Assessment of Functional Repercussions that revealed day-to-day life difficulties in activities requiring reasoning, verbal memory or selective attention. Clinical assessments revealed a euthymic mood at baseline according to Bech criteria (Bech, 1989). Furthermore, at baseline, the patient had a good insight (Marks et al., 2000), an average social desirability (Crowne & Marlowe, 1960) and a good general physical health and functioning, despite a low average social functioning, and a global limitation in everyday life due to physical and emotional problems (Ware et al., 1994).

After therapy, the patient was suffering from important depressive symptoms (HAMD-17=17). Despite symptom worsening, several cognitive and functional improvements were observed. The Perceptual Reasoning Index, our main outcome, improved from the percentile rank 18 to 66, indicating a normalization of the patient's score above the median of the general population. The patient also demonstrated a score normalization in other executive functions, such as inhibition (SCWT Interference), visual (Matrix Reasoning) and verbal abstraction (Similarities), as well as a moderate improvement in planning (Key Search Test). The patient also improved his performances in processing speed and attentional abilities (Processing Speed Index Score; SCWT Color and Word). Furthermore, we observed improvements in emotion recognition (Emotion Hexagon), even thought this cognitive ability wasn't impaired before therapy. As expected, we observed no general improvement in the most efficient cognitive functions, such as working memory (Working Memory Index Score) or verbal abilities (Verbal Comprehension Index Score), due to a ceiling effect in the tests. Surprisingly, we observed no effect of therapy on verbal memory: the patient had the same results before and after therapy concerning the retrieval of semantic information (Categorical Verbal Fluencies); in the Rey Auditory Verbal Learning Test, the patient recalled less words after therapy, despite a maintained learning potential.

The Assessment of Functional Repercussions revealed that the patient observed improvements in his day-to-day life, mainly in activities requiring attentional abilities, but also in activities involving verbal memory and reasoning. Consistently, Mister F. expressed no more difficulties with reading or writing when there is noise around, remembering names or planning activities. He was able to remember and discuss with relatives the content of the lectures he attends to. Furthermore, he developed compensatory strategies such as focusing his attention on the location of his personal

effects and checking for them regularly. However, the patient had remaining difficulties for focusing on a specific thought.
Finally, after therapy, despite lower general and mental health probably due to his depressive symptoms, the patient maintained a good insight and an average social desirability, and showed less functional limitation due to physical and emotional problems.

4. Discussion

We developed a new individual cognitive remediation program for bipolar patients that aims to improve patients' cognitive functioning by intensive training and development of problem solving skills, as well as their knowledge and confidence in their cognitive abilities to deal with everyday life situations. We realized a first case study on a 62 years old bipolar patient that suffered from reasoning, selective attention, memory and planning impairments.
After therapy, despite important depressive symptoms, the patient showed a general improvement in previously impaired executive functions, as well as attentional abilities and speed of processing. Particularly, our main outcome, the Perceptual Reasoning Index Score, was normalized after therapy. These results are in keeping with studies on the effect of CR on cognitive impairments in schizophrenia (McGurk et al., 2007), as well as a previous study that observed an effect of CR on executive functions in bipolar disorders (Deckersbach et al., 2010).
Moreover, after therapy, the patient expressed functional improvements in activities requiring attentional abilities, verbal memory and reasoning, as well as less limitations in his everyday life. These observations are in accordance with studies that observed an improvement in psychosocial functioning for bipolar patients after CR (Torrent et al., 2013; Demant et al., 2015). Even though daily functioning was assessed by questionnaires in this case study, it is worth mentioning that the patient had a good insight and an average social desirability at baseline, both of which suggesting a good reliability of the clinical scales. In addition, AFR was scored by three independent clinicians and a final rating was reached through consensus, even reducing the risk for rater-induced biases.

Interestingly, the improvement in selective attention was observed both in cognitive and functional assessments, possibly showing a generalization of learned strategies in real life. On the other hand, the AFR scale showed a slight improvement in reasoning whereas we observed major

improvement after therapy in the neuropsychological assessment, suggesting that the transfer of skills is not fully effective yet. On the contrary, the slight improvement in verbal memory we observed with the AFR is in contradiction with the decrease in recalled words after therapy in the RAVLT, despite a maintained learning score. This result can be explained by the use of a parallel list after therapy that uses words that are less frequent that the ones in the baseline list (Hawkins et al., 2004). Another hypothesis may be that mnesic strategies learned during therapy couldn't be used by the patient in the RAVLT. A previous study also failed to observe an effect of CR on the RAVLT recall score (Demant et al., 2015).

This case study shows several limitations. Despite a good test-retest reliability of our neuropsychological assessments, and the WAIS-IV in particular (Wechsler, 2008), practice effects may have occurred. Moreover, improvements in verbal and spatial reasoning may have been caused by mood changes during therapy. The worsening of depressive symptoms after therapy may have improved the patient's verbal abstract reasoning abilities, as such improvements have been observed in depressed type I bipolar patients (Yates et al., 2011). Although, the increase of the patient's symptomatology is less likely to cause improvements of other cognitive functions such as processing speed or attention.

5. Conclusions

This first case study using the ECo program yields promising results that need to be replicated in a randomized controlled trial. Questions addressed by this clinical illustration may be investigated in a larger study, namely: a. the positive impact of ECo on executive functions and attention; b. a questionable effect on verbal memory; c. the discrepancy between cognitive and functional results; d. the possible weight of mood variation on neuropsychological and functional improvements.

A randomized controlled study with a double-blind design is currently in progress to investigate the effect of the ECo program on cognitive functions and psychosocial functioning, after therapy and at a six-month follow-up (NCT02698696). This clinical trial aims to compare ECo to a positive control CR program developed for schizophrenia and to a control therapy without any cognitive training.

Tables

MODULES	SUB-MODULES			
Psychoeducation	Cognitive impairments		Training cognitive functions	
Attention	Sustained attention	Selective attention	Cognitive flexibility	Divided attention
Memory	Working memory	Storage	Associative memory	Retrieval
Executive functions	Abstraction	Inhibition	Categorization	Planning
Functional impairments	Inductive reasoning	Social interactions	Deductive reasoning	Autonomy
Tools	*Tokens*	*Chessboard*	*Cards*	*Maps*

Table 1. Structure of the ECo program

Authors' suggestions	**ECo**
Focus on impaired functions in BP (Bora et al., 2009; Tiihonen et al., 2005)	• Inhibition sub-module • Visual and spatial reasoning exercises • Many exercises with an inhibition or visual reasoning component
Metacognitive training (Martínez-Arán et al., 2011 ; Vianin, 2007)	• 5 metacognitive training exercises • A psychoeducation module
Social skills training (Medalia & Choi, 2009 ; Wykes & Spaulding, 2011)	• Contextualized exercises • Fifth module that aims to help the patient use efficient strategies in everyday life
Individualized program (Wykes & Spaulding, 2011)	• A large number of exercises (20 per module) • For one cognitive function, exercises working on different media or aspects of the cognitive function • Order of the modules defined according to the patient's impairments and complaint
More complex exercises (Dekersbach et al, 2010)	• Exercises with ten levels of difficulty

Table 2. Highlights on ECo's specificities based on authors' suggestions.

Neuropsychological assessments		Baseline percentile	M3 percentile	M3-baseline percentile
WAIS-IV - Index Scores	Verbal Comprehension	61	97	36,00
	Perceptual Reasoning	18	66	48,00
	Working Memory	97	99	2,00
	Processing Speed	34	55	21,00
WAIS-IV - Subtests	Block Design	25	25	0,00
	Matrix Reasoning	37	91	54,00
	Visual Puzzles	9	63	54,00
	Similarities	5	91	86,00
	Vocabulary	98	99,9	1,90
	Information	91	95	4,00
	Digit span forwards	95	99	4,00
	Digit span backwards	99	99	0,00
	Digit span sequencing	25	84	59,00
	Arithmetic	98	98	0,00
	Symbol Search	25	37	12,00
	Coding	50	75	25,00
Key Search Test		11	33	22,00
Rey Auditory Verbal Learning Test	Sum	27	10	-17,00
	Learning	75	75	0,00
Stroop Color-Word Test	Color	47	57	10,00
	Word	69	80	11,00
	Interference	40	59	19,00
	Interference-Color	39	58	19,00
Verbal Fluencies	Formal – Letter P	81	87	6,00
	Categorical - Animals	28	24	-4,00
Emotion Hexagon		50	74	24,00

Table 3. Results of the neuropsychological assessments

		Baseline	M3
HAMD-17*		7	17
YMRS*		4	0
AFR	Verbal Memory*	6	5
	Spatial Memory*	3	3
	Working Memory*	4	4
	Selective Attention*	6	3
	Reasoning*	6	5
SF-36	Physical Functioning	95	95
	Role limitation due to Physical health	0	75
	Bodily Pain	87.5	65
	General Health	87.5	33.3
	Summary Physical	67.5	67.1
	Vitality	30	25
	Social Functioning	37.5	37.5
	Role limitation due to Emotional problems	33.3	66.7
	Mental Health	44	28
	Summary Mental	36.2	39.3
SAIQ	Need for Treatment*	9	9
	Outcome of Illness*	7	6
	Worry*	10	10
	Total*	26	25
SDS	Attribution	7	12
	Denial	4	5
	Total	11	17

Table 4. Results on mood and psychosocial functioning.

** Reversed scored scales: a lower score indicates a more stabilized mood, better functional abilities, or a greater insight*

Abstract

Introduction: Recent research assumes that cognitive deficits are core features, indeed trait markers of bipolar disorders. They have been identified both on a behavioral and a cerebral level, and have been proved to lead to a significant disability in psychosocial functioning and quality of life. Nevertheless cognitive deficits remain underdiagnosed and difficult to treat. It is now well documented that cognitive remediation programs succeeded in improving neurocognitive deficits in schizophrenia, but few studies observed their effect on bipolar disorders. We explain their limited efficacy by a lack of targeted interventions on specific cognitive deficits in mood disorders.

Objectives: Our objective was to design an ecological cognitive remediation program dedicated to bipolar disorders and to test its efficacy on cognition and psychosocial functioning.

Methods: We first validated the content of our cognitive remediation program in a sample of 35 healthy volunteers. Second, we proposed this program to a patient suffering from a bipolar disorder. We conducted a cognitive assessment with standardized neuropsychological tests before and after the 28 sessions of the program. We assessed the patient's mood and psychosocial functioning with self and rater-administered questionnaires.

Results: We observed major improvements both in cognition and psychosocial functioning, which seem to be independent from mood changes. Moreover the patient suffered from less physical and emotional limitations in his life.

Conclusions: Results support the hypothesis of the efficacy of a cognitive remediation program specifically designed for mood disorders. Our ongoing randomized double-blind study intends to specify these clinical results.

Highlights

- An ecological cognitive remediation program dedicated to bipolar disorders was designed
- A case study of the cognitive and functional effect of the ECo program is presented
- After 28 sessions, improvements in neurocognition and psychosocial functioning were observed
- A randomized double-blind controlled study is needed to assess the efficacy of the program