Inferential Confusion, Cognitive Change and Treatment Outcome in Obsessive–Compulsive Disorder

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Inferential confusion has been defined as a confusion between reality and possibility, where the person with Obsessive–Compulsive Disorder (OCD) persists in his/her obsessional belief despite sense information to the contrary. The current study investigates whether inferential confusion is associated with treatment outcome in an OCD sample receiving cognitive–behavioral therapy (CBT). Results indicated that changes in inferential confusion as measured by the Inferential Confusion Questionnaire (ICQ) were significantly associated with treatment outcome. In addition, inferential confusion showed differential validity as a cognitive marker in OCD and was specifically associated with change in obsessive–compulsive symptoms during treatment, rather than confounded with change in negative mood states. Results are discussed in terms of the importance of the concept of inferential confusion for obsessive–compulsive disorder with and without schizotypal characteristics. Copyright © 2005 John Wiley & Sons, Ltd.

INTRODUCTION

In recent years, the concept of inferential confusion has been proposed as a cognitive factor contributing to the development and maintenance of OCD (Aardema & O’Connor, 2003; O’Connor, 2002; O’Connor & Robillard, 1995, 1999). Inferential confusion has been defined as a confusion between reality and possibility, where the person treats the obsessional belief as a valid probability rather than recognizing the obsession as an imagined possibility. A crucial aspect of inferential confusion is a distrust of the senses, and a reverse type of reasoning, where the person comes to infer a possible state of affairs in reality despite the presence of sense information to the contrary. For example, the person with OCD sees and knows the door is closed yet continues to persist in the possibility that the door is not closed. These inferences of possibility (‘I might have left the door unlocked’; ‘I might be contaminated’) take on obsessional characteristics, because in OCD patients they have come about on the basis of a purely subjective rationale, which attenuates the incorporation of sense information to disengage from the obsession and associated compulsive behaviours. For example, a person who washes his/her hands, but...
not on the basis of seeing only dirt, will have difficulty deciding whether his/her hands are clean even after repeated washing.

Several studies have shown inferential confusion to be related to obsessive–compulsive symptoms. A study by Emmelkamp and Aardema (1999) found inferential confusion to be independently related to most forms of obsessive–compulsive symptoms while controlling for depression and 13 other cognitive domains. Similar relationships were found in another study that found a relationship with most obsessive compulsive symptoms while controlling for neuroticism (Aardema, Kleijer, Trihey, O'Connor, & Emmelkamp, manuscript submitted for publication). In two recent studies with an OCD sample inferential confusion independently added to the prediction of obsessive–compulsive symptoms beyond the variance already explained by obsessive–compulsive beliefs, and also accounted for the major part of the variance between obsessive–compulsive beliefs and obsessive–compulsive symptoms (Aardema, O'Connor, Emmelkamp Marchand, & Todorov, 2004; Aardema, O'Connor, & Emmelkamp, manuscript submitted for publication). These studies have highlighted the importance of investigating the reasoning processes in OCD that are associated with the occurrence of obsessions.

An inference based approach primarily conceptualizes OCD as a belief disorder, and as such emphasizes non-phobic elements in the development and maintenance of this disorder (O'Connor & Robillard, 1995). Rather than locating the origin of obsessions in intrusions, it conceptualizes obsessions as primary inferences (’The cooker might be left on’; ’I may have been contaminated’). These inferences come about as the result of prior reasoning. In this model, there is no such phenomenon as an intrusion; rather there is an initial perception of a real event or object, followed by an inference about a related state of affairs, which in turn forms the conditional premise (if X then . . . ) for a series of secondary deductions about consequences and how such consequences will be appraised and interpreted. The formulation of the primary inference represents the first step in the inferential confusion process where an imaginary possibility becomes taken as a genuine likelihood (O'Connor & Robillard, 1999). The initial doubt (e.g. ’maybe I am contaminated’) is maintained by an idiosyncratic reasoning process, which invests meaning in the initial thought (primary inference), and subsequently spirals off to secondary aversive consequences (secondary inferences), leading to appraisals of the obsessional thoughts (’it is terrible to have such thoughts’) and perhaps further coping appraisals (’I can’t deal with this problem’, ’I’m out of control’).

Since the concept of inferential confusion primarily deals with the imaginary nature of obsessions it would be expected to be particularly relevant to OCD with delusional or schizotypal characteristics. Indeed, inferential confusion is associated with schizotypal symptoms (Aardema, Kleijer, Trihey, O'Connor, & Emmelkamp, manuscript submitted for publication), and those with delusional disorder have been found to score as high on inferential confusion as those with OCD (Aardema et al., 2004). The overlap between OCD and schizotypy has led some to suggest that OCD can better be characterized as a schizotypal disorder than an anxiety disorder (Enright & Beech, 1990). In particular, psychotic-like symptoms such as fixity of belief, perceptual aberration and magical ideation are present in some subgroups of OCD patients, and these types of symptom have been found to be associated with poor treatment outcome (Jenike, Baer, Minichiello, Schwartz, & Carey, 1986; Eisen & Rasmussen, 1993; Foa, 1979; Foa, Abromowitz, Franklin, & Kozak, 1999; Moritz et al., 2004). However, while research findings appear to indicate that at least some schizotypal symptoms do play a role in obsessive–compulsive disorder, there is currently no coherent conceptualization as to the exact nature of the relationship between schizotypal symptoms and OCD. In terms of the inferential confusion process, however, these psychotic-like symptoms can be viewed as the far end of the inferential confusion dimension, which signifies a cross-over point leading from reality into the imagination, and where the obsessional inference becomes a ’lived in’ reality (O’Connor & Aardema, 2003, 2004). Indeed, where both levels of inferential confusion and perceptual disturbances are high, obsessive–compulsive symptoms seem to be more severe (Aardema, Kleijer, Trihey, O’Connor, & Emmelkamp, manuscript submitted for publication).

However, it is as yet unclear whether inferential confusion constitutes a reasoning bias that is primarily associated with OCD with schizotypal characteristics or whether it represents a general reasoning bias in OCD as psychometric findings appear to indicate (Emmelkamp & Aardema, 1999; Aardema et al., 2004). Regardless of the exact nature of the relationship of inferential confusion with schizotypal or psychotic-like characteristics in OCD, cognitive–behavioural treatment specifically
targeting inferential confusion has been found to be more effective than conventional CBT for those with stronger obsessional conviction (O’Connor et al., in press). In particular, those who showed a strong conviction level on an idiosyncratic measure of obsessions benefited more from an inference based approach (IBA) than those who showed lower conviction levels. However, this study did not include a measure of inferential confusion, and results remain tentative as to whether inferential confusion is an active cognitive ingredient in therapy associated with treatment outcome for obsessive–compulsive disorder in general.

The importance of the cognitive element in treatment programs for OCD remains contentious. Treatment studies based on (meta)-cognitive models seem to offer effective treatment, but it is unclear whether cognitive change precedes or follows improvement in symptoms (Réháumé & Ladouceur, 2000). Some have suggested that current measures of cognitions may reflect change in mood states rather than change in cognitive beliefs, and that the importance of cognitive change in these beliefs in treatment is far from conclusive (Emmelkamp, 2002). For example, a treatment outcome study carried out by Emmelkamp, Van Oppen, and Van Balkom (2002) did not find a significant difference in change in obsessional beliefs as measured by the OBQ between non-responders and responders.

The main goal of the present study is to establish whether changes in inferential confusion are associated with treatment outcome in a sample of OCD patients receiving standardized CBT involving the use of cognitive challenges and reality testing following published guidelines (Van Óppen & Arntz, 1994; Freeston, Réháumé, & Ladouceur, 1996; Salkovskis, 1999) without specifically targeting inferential confusion (O’Connor & Robillard, 1999). Thus, the approach focused on education in the normalization of intrusions with subsequent challenges of the exaggerated conclusions and appraisals using socratic dialogue or other cognitive techniques, while exposure elements were presented to the client in a ‘reality testing’ format.

In line with our theoretical formulation we hypothesized the following: (1) greater changes in inferential confusion would be associated with improved treatment outcome; (2) inferential confusion represents an independent process from appraisals and reactions to the obsession. In addition, we carried out two further exploratory investigations concerning the relationship of inferential confusion with conviction levels in primary infer-

ences, and the extent to which inferential confusion is a predictor for poor treatment outcome.

METHOD

Participants

Participants in the study were recruited through referrals to our research clinic, followed by a two-stage process using telephone screening interviews and by initial questionnaires returned by post and a face-to-face diagnostic interview with one of the participating psychiatrists. Baseline diagnosis used three structured interviews to provide adequate description of clinical features. First, all patients were diagnosed using the Anxiety Disorders Interview Schedule for DSM-IV, a structured interview that diagnoses anxiety disorders and exclusionary conditions (see below) (ADIS-IV; Brown, Di Nardo, & Barlow, 1994). Second, participants were administered the Yale–Brown Obsessive–Compulsive Scale (Y-BOCS; Goodman et al., 1989a, 1989b). Positive response to any of these screens led to use of appropriate sections of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) (First, Spitzer, Gibbon, & Williams, 1997) to complete the differential diagnosis. Entry criteria were (a) a primary diagnosis of OCD, (b) presence of overt compulsions for at least one hour a day, (c) no evidence of suicidal intent, (d) no evidence of current substance abuse, (e) no evidence of current or past schizophrenia, bipolar disorder or organic mental disorder.

Participants who met the entry criteria received cognitive-behavioural therapy for the duration of a 20-week course of treatment. All participants were seen individually by therapists for a period of four evaluations sessions and 20 treatment sessions. Participants were evaluated by an independent clinician after 10 weeks, to evaluate whether there were any contra-indications to continuing treatment (worsening of condition, new condition, motivation problem, inability to progress in current treatment). If there were contra-indications, the participant was withdrawn from the research program and referred to more appropriate standard management. A total of nine people abandoned treatment or were withdrawn from the study for various reasons (no progress, lack of motivation, unable to complete the exercises or to keep appointments, etc). The final sample consisted of 35 participants (15 males and 20 females), who completed the 20 week therapy. Mean age was
40.1 years. No significant differences were found between those who abandoned or completed treatment on any of the socio-demographic data.

**Main Dependent Variables**

The main dependent variables assessed symptoms and cognitions that were direct targets of the intervention.

**Clinician Assessment: Yale–Brown Obsessive-Compulsive Scale (Y-BOCS)** (Goodman et al., 1989a, 1989b)

The Y-BOCS is the instrument of choice for clinician assessment of OC symptoms and severity. An independent assessor administered the Y-BOCS at pre-, mid-, post-treatment, and follow-ups. Following pre-treatment assessment (ADIS, Y-BOCS and SCID-I) and before therapy, all patients received four individual one-hour evaluation sessions. The Y-BOCS was administered by a trained independent clinician and was defined as the primary outcome variable.

**Questionnaire Symptom Measures: The Inferential Confusion Questionnaire (ICQ-15; Aardema et al., 2004)**

This questionnaire measures several key aspects of inferential confusion as formulated by O’Connor and Robillard (1995). Factor-analyses have indicated that the ICQ is a unidimensional measure that independently contributes to the prediction of obsessive-compulsive symptoms while controlling for other cognitive domains and negative mood states. Items reflect a tendency to distrust the senses and to inverse inference, where the person infers a state of affairs in reality without any actual indication of it being present or even in contradiction to what is seen or sensed. The 15 items ($\alpha = 0.92$) of the ICQ-15 are scored on a five-point scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. The Padua Inventory (Sanavio, 1988) is a comprehensive 60-item self-report inventory of obsessions and compulsions. The total scale ($\alpha = 0.96$) and the subscales are reliable ($\alpha = 0.75$–0.91). The Beck Anxiety Inventory (BAI) (Beck, Epstein, Brown, & Steer, 1988) is a 21-item anxiety symptom checklist rating symptom intensity for the last week on a 0–3 scale ($\alpha = 0.82$). The Beck Depression Inventory (BDI) (Beck, Rush, Shaw, & Emery, 1979) is a 21-item measure of depressive symptoms ($\alpha = 0.92$).

**Clinician Rated and Self-Monitored Inference Processes**

Inference processes relevant to the IBA were assessed to identify primary and secondary inferences through interview techniques following a logical template as developed by O’Connor & Robillard (1999). For example:

**Client**

(C): If I don’t wash my hands, I might get ill.

**Therapist**

(T): And you would get ill if what state of affairs is true?

(C): Well, if my hands are not clean.

(T): So you’re washing your hands for what?

(C): Well, to make sure there are no dangerous germs on my hands.

(T): So, when you go to wash, precisely what thought comes into your head?

(C): That there might be dangerous germs on my hands.

The primary inference or doubt in this instance is ‘There might be dangerous germs on my hands’ followed by the secondary inference ‘(Then) I will become ill’.

Strength of primary inferences and secondary inferences were measured by the therapist for each obsession completed pre- and post-treatment (0–100). The primary inference was measured (e.g. my hands could be dirty; the door might be unlocked) in terms of degree of probability (0–100) (e.g. how probable is it that your hands might be dirty?; how probable is it that the door is unlocked?). The secondary inference (e.g. if my hands are dirty, I’ll contaminate my whole family; if my door is unlocked I’ll be robbed) was rated according to how realistic the consequence was (0–100). In accordance with the IBA model, we considered a highly rated degree of probability in the primary inference as indicative of an over-investment in this obsessional doubt.

**Therapists**

CBT interventions were carried out by five therapists skilled in cognitive–behavioural treatment. Three of the therapists were licenced psychologists, whereas the others were doctoral students. All therapists were trained by an experienced clinical psychologist specialized in cognitive–behavioural therapy in the form of workshops and
regular meetings. In the course of treatment, therapists were supervised individually on a weekly basis; bi-weekly meetings were held with all therapists to discuss cases and ensure treatment integrity.

RESULTS

Reliability

The ICQ was administered twice pretreatment in order to establish the reliability of the ICQ. Elapsed time between administration was approximately 3 months. Test–retest correlation between the two measurements was 0.74 ($p < 0.01; n = 32$).

Treatment Outcome

Means and standard deviations before and after treatment of the process variables and outcome measures are represented in Table 1. Paired sample $t$-tests were performed to establish whether or not treatment was successful in reducing symptoms. Scores on obsessive–compulsive symptoms (Y-BOCS), depression (BDI) and anxiety (BAI) significantly reduced in the course of treatment. Likewise, scores on primary inference, secondary inference and inferential confusion were significantly lower post-treatment as compared with pre-treatment levels.

Responders and Non-Responders

In order to establish whether changes in inferential confusion were relevant to treatment outcome the sample was divided between responders and non-responders. Treatment responders were defined as 33% or more improvement post-treatment as compared to pre-treatment scores on the Y-BOCS (cf. Emmelkamp et al., 2002). This criteria led to the identification of 11 non-responders and 19 responders. Individual $t$-tests were performed in order to establish whether changes in ICQ scores were significantly different for non-responders versus responders (see Table 2). Similarly, we calculated whether changes in primary inference and secondary inference were significantly different for both groups.

Non-responders decrease significantly less than responders on inferential confusion in the course of treatment. In fact, almost no change was observed on inferential confusion scores among the non-responders. There was however no significant difference between non-responders and responders in changes on primary inference, while

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***$p < 0.001$. **$p < 0.01$. 

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<th>Table 2. Differences between non-responders and responders in changes on inferential confusion, primary inference and secondary inference</th>
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***$p < 0.001$. *$p < 0.05$. 

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responders improved significantly more on secondary inference than non-responders.

Finally, we calculated whether initial scores on the process variables would predict treatment outcome in terms of Y-BOCS scores. Pearson correlations showed that baseline scores on the ICQ, primary inference and secondary inference were not significantly related to changes in Y-BOCS scores before and after treatment. Thus, baseline scores on these measures did not predict poor treatment outcome.

Inter-Relationships Among Cognitive Measures Pre- and Post-Treatment

We calculated the relationships between the process measures (inferential confusion, primary inference and secondary inference) before treatment in order to establish whether these measures represent independent aspects of obsessional thinking (see Table 3). Level of conviction in primary inference and realism of secondary inference was established by calculating the mean of scores on the three highest scoring obsessions in the hierarchy of the clinical scales for each participant.

Inferential confusion was not related to levels of primary inference and secondary inference pre- and post-treatment. Pre-treatment levels of inferential confusion were significantly related to post-treatment levels of inferential confusion. Pre-treatment levels of primary inference and secondary inference were not related to their respective post-treatment levels. As expected, primary inference and secondary inference are significantly related to each other at pre- and post-treatment. Also, post-treatment levels of secondary inference were significantly related to pre-treatment levels of primary inference, whereas post-treatment levels of primary inference were not related to pre-treatment levels of primary inference.

Changes in Inferential Confusion and Symptom Measures

We calculated the relationship between changes in inferential confusion with change in Y-BOCS and the Padua total score. Change in inferential confusion was both significantly related to change in Y-BOCS scores ($r = 0.44; p < 0.05$) as well as change in Padua scores ($r = 0.46; p < 0.05$). Also, in order to investigate the differential validity of inferential confusion as a measure for treatment outcome in obsessive–compulsive disorder we also calculated the relationship between changes in inferential confusion with changes in anxiety and depression pre- and post-treatment. Pearson correlations showed a non-significant relationship of change in inferential confusion with change anxiety (0.27) and depression (0.29), thereby providing evidence for the unique relevance of the inferential confusion process for obsessive–compulsive symptoms, independent of anxiety and/or depression, as a measure for treatment outcome. However, the relationship between change in Y-BOCS scores and change in inferential confusion does decrease to a non-significant trend when controlling for anxiety ($r = 0.35; p = 0.11$) or depression ($r = 0.38; p = 0.08$).

DISCUSSION

The principal aim of the current study was to establish whether changes in inferential confusion are

| Table 3. Interrelationships between inferential confusion (ICQ), primary inference (PI) and secondary inference (SI) |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| ICQ                                             | PI                                              | SI                                              |
| Pre    | Post | Pre    | Post | Pre    | Post |
| Inferential confusion (ICQ)                     |                                                 |                                                 |
| Pre    | $0.55^{**}$ | $0.07$          | $0.08$          | $-0.21$          | $0.07$          |
| Post   | $1.00$          | $-0.26$         | $0.33$         | $-0.28$          | $0.37$          |
| Primary inference (PI)                         |                                                 |                                                 |
| Pre    |      | $1.00$         | $0.33$         | $0.69^{***}$     | $0.44^{*}$     |
| Post   |      | $1.00$         |          | $0.21$         | $0.93^{***}$  |
| Secondary inference (SI)                       |                                                 |                                                 |
| Pre    |      |               |               | $1.00$         | $0.29$          |
| Post   |      |               |               |               | $1.00$          |

$^{***} p < 0.001$. $^{**} p < 0.01$. $^{*} p < 0.05$.
 Indeed, inferences are higher in terms of conviction level. Sense that the relationship is stronger if primary strength of primary and secondary inference in the relationship is non-linear between non-responders and responders, whereas secondary inferences did discriminate between the two groups. This is not entirely surprising, since conviction levels as measured by the primary inference have been proposed to operate independently from the severity of obsessive–compulsive symptoms, but largely come into play when obsessional conviction is high and where primary inferences dictate subsequent reactions to the obsession in terms of secondary inferences and symptomatology (O'Connor et al., in press). In addition, primary inferences were not specifically targeted during treatment and previous research has shown that there is a non-linear relationship between strength of primary and secondary inference in the sense that the relationship is stronger if primary inferences are higher in terms of conviction level. Indeed, post hoc analyses on the relationship between primary and secondary inferences in a subsample of the current study shows a non-significant relationship if the primary inference is lower than 50 ($r = 0.17; p = 0.50$).

The current results indicate that inferential confusion is not related to the level of conviction with which primary inferences are held, nor was there a relationship with secondary inferences. The latter confirms our expectation that inferential confusion represents a process that operates independently from appraisals and reactions to the obsession that follow logically from the primary inference. In addition, the lack of a relationship between inferential confusion and primary inferences suggests that inferential confusion operates as a general reasoning bias in OCD. Thus, although the concept of inferential confusion was inspired by clinical observations of OCD with overvalued idea-tion (O’Connor & Robillard, 1995), it is distinct from the strength of these schizotypal characteristics. However, the relationship between inferential confusion and other schizotypal characteristics in OCD remains of interest, since besides inferential confusion representing a non-phobic characteristic in OCD that leads the imagination to trump the senses it may account for a variety of other schizotypal symptoms in OCD. In particular, one would expect that inferential confusion accounts for some schizotypal characteristics in OCD where absorption into imaginary sequences leads to several perceptual disturbances. While the person with OCD may continue to perceive reality correctly (Brown et al., 1994), such absorption may hamper the incorporation of sense information in the decision process to disengage from neutralizing behaviours as well as increase the intensity and persistence of obsessions (O’Connor & Aardema, 2003).

The final aim of the current study was to establish whether inferential confusion was a predictor for poor treatment outcome. However, inferential confusion, unlike other schizotypal characteristics such as perceptual disturbances and delusional thinking, was not found to be a predictor for poor treatment outcome. Likewise, obsessional conviction or high investment in the obsessional doubt as measured by the primary inference was not related to poor treatment outcome either. However, the measurement of obsessional conviction in terms of primary inferences has been found to be empirically meaningful in that those who are characterized by high obsessional conviction benefit more from an inference based approach than standard cognitive–behavioural therapy (O’Connor et al., 2004). In addition, the level of primary inference or insight may vary over obsessions within the same subject and may be a function of degree of absorption. Further refinement of the measurement of conviction levels in primary inferences may be necessary, in particular with regard to the measurement of primary inferences both inside and outside the OCD situation in order to obtain a more refined measure of the ego-dystonic and ego-syntonic experience of obsessions.

So far, it appears that the investigation of OCD from an inference based approach aids the identification of cognitive markers relevant to this disorder. In this respect, it is important to note that cognitive approaches to OCD, which emphasize the exaggerated interpretation of intrusive cognitions, have faced several difficulties on account of the modest relationship between cognitive beliefs and treatment outcome (Emmelkamp, 2002). Consequently, it has been suggested that changes in current measures of cognitive beliefs and appraisals may be an epiphenomenon of changes in mood states (Emmelkamp, 2002). Changes in cognition may of course be artifacts of successful treatment and hence the importance in the present study of the differential relationships between the ICQ and treatment outcome variables. In particu-
lar, it is noteworthy that changes in inferential confusion were related to changes in Y-BOCS and Padua scores, but not related to changes in anxiety and depression. Further research in this area is important, since cognitive measures that are able to show differential effects on treatment outcome represent the next evolution in the measurement of cognitive markers proposed for OCD.

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