Association Splitting for Obsessive-compulsive Disorder: A Systematic Review

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Abstract: Background: Association splitting is a cognitive technique that targets obsessions in obsessive-compulsive disorder (OCD) by weakening biased semantic associations among OCD-relevant concepts.

Objective: In this systematic review, we examine studies on the efficacy of association splitting for reducing OCD symptoms.

Methods: Following PRISMA guidelines, six studies were included, with diversity in sample characteristics, mode of administration (i.e., self-help vs therapist-assisted), language of administration, comparator groups, etc.

Results: Results indicated that association splitting, as a self-help intervention, was efficacious in reducing overall OCD symptom severity, specific OCD symptoms (i.e., sexual obsessions), subclinical unwanted intrusions, and thought suppression, with small-to-large effect sizes (e.g., across relevant studies, $d_s = .28-1.07$). Findings were less clear when association splitting was administered on a therapist-assisted basis as an add-on to standard cognitive-behavior therapy (CBT). Nonetheless, across studies, the majority of participants reported high acceptability, ease of comprehension, and adherence to daily association splitting practice.

Conclusion: Although association splitting is an efficacious and acceptable self-help intervention for OCD symptoms, future studies should include appropriate comparison groups, conduct longitudinal assessments, examine efficacy for different symptom dimensions, and assess changes in semantic networks as proof of mechanistic change. There should also be greater representation of marginalized groups in future studies to assess association splitting’s utility in circumventing barriers to face-to-face CBT. Ethical considerations are also discussed.

Keywords: Obsessive-compulsive disorder, association splitting, semantic network, intervention, psychotherapy, cognitive-behavior therapy.

1. INTRODUCTION

Obsessive-compulsive disorder (OCD) is characterized by repetitive, intrusive thoughts (i.e., obsessions) that trigger ritualistic behaviors (i.e., compulsions), which are performed in order to reduce the distress induced by obsessions [1]. In a cognitive-behavioral framework, obsessions and compulsions are functionally connected [2]; compulsions temporarily relieve anxiety caused by obsessions, but paradoxically strengthen the learned link between distressing content of obsessions and the need to perform compulsions (i.e., negative reinforcement of OCD symptoms) [3]. Cognitive-behavioral theories of OCD additionally emphasize dysfunctional beliefs about intrusive thoughts in the development of OCD [4]. These include thought-action fusion (TAF) beliefs that exaggerate the relationship between intrusive thoughts and the likelihood of events occurring [5, 6], and have been consistently linked to OCD symptom severity [7-9]. As such, several evidence-based guidelines for OCD recommend cognitive-behavior therapy (CBT) as a first-line treatment for OCD [10].

CBT, when competently administered, reduces OCD symptoms with large effect sizes [11]. These treatment gains are also long-lasting, with gains maintained at 6 months to one year [12]. Cognitive therapy (CT) aims to normalize intrusive thoughts, provide psychoeducation about the negative reinforcement cycle of anxiety, and challenge/restructure dysfunctional beliefs about feared outcomes in obsessions.
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and/or the necessity of compulsions [13], leading to reductions in OCD symptoms [14]. Exposure and response prevention (Ex/RP) [15] is also an effective behavioral treatment usually used as part of CBT treatment for OCD [16]. Ex/RP compels patients with OCD to confront and disconfirm their fears (i.e., ‘exposure’), while preventing the performance of rituals (i.e., ‘response prevention’) that would otherwise hinder the emotional reprocessing and relearning [15]. If successful, Ex/RP results in intrusive thoughts no longer triggering as much, or any, fear, anxiety, or urge to perform compulsions. Treatment outcome studies have shown that Ex/RP produces clinically significant and sustained reductions in OCD symptoms [17, 18], although about 14-25% of patients with OCD refuse to undergo or drop out of Ex/RP treatment [11, 19, 20]. Furthermore, Ex/RP tends to be efficacious across most OCD symptom dimensions, even though patients with primary symptoms in the unacceptable/taboo thoughts domain (e.g., sexual, religious, or otherwise immoral/repugnant obsessions) tend to show a poorer response [21, 22].

The existing need to optimize first-line psychological treatments for OCD has stimulated research on innovative, supplemental means of treating OCD. As such, CBT-consistent cognitive research has recently introduced novel ways to conceptualize symptoms of OCD. The semantic network conceptualization of obsessions is one such approach [23]. A semantic network is defined as a collection of concepts linked to one another in memory [24]. Communication among concepts occurs via ‘spreading activation’ of their meaningful associations with each other [25-28]. According to this approach, obsessions in OCD are viewed as exaggerated activations of OCD-relevant concepts within the semantic network [29]. Therefore, a patient with, for example, harm obsessions will more likely associate the word ‘stove’ with his fear of accidentally burning the house down by leaving the stove on, rather than neutral or positive, OCD-relevant associations with the word ‘food’ (i.e., ‘cooking delicious food on the stove’). This hypothesis of biased semantic networks in OCD is supported by studies in which participants with OCD generated significantly more negative, OCD-relevant associations to cue words than healthy controls [30, 31]. Furthermore, according to the semantic network approach, OCD-relevant associations are strengthened and become more easily activated over time when patients continue to focus and elaborate on their obsessions (e.g., intrusive thoughts of sexually harming a child triggering additional thoughts such as, “I must be a pedophile!”) and perform compulsions [32].

In line with the semantic network approach to OCD, Moritz and colleagues developed the self-help cognitive technique of association splitting to reduce biased OCD-relevant associations, hence obsessions, in OCD [23]. The technique is meant to supplement, not substitute, standard psychotherapies for OCD. In association splitting, individuals with OCD identify a few concepts at the core of their obsessive fears (e.g., ‘virus,’ ‘germ,’ and ‘infection’ for contamination OCD), and practice generating neutral or positive, OCD-irrelevant associations (e.g., ‘viral video,’ ‘wheat germ,’ and ‘infectious laughter’) to these concepts on a daily basis, outside of obsessive intervals [23]. The goal of association splitting is to maximize the ‘fan effect’ in the semantic network [33]. The ‘fan’ refers to the number of associations within the semantic network. Essentially, association splitting weakens OCD-relevant associations by increasing the number of competing, non-OCD-relevant associations (i.e., ‘fanning out,’ or distributing, limited activation energy among a greater number of links in the semantic network). By redirecting spreading activation away from OCD-relevant associations to additional, new OCD-irrelevant associations, the former are hypothesized to weaken over time, while the latter are hypothesized to strengthen with practice. At the symptom level, obsessions (and compulsions) are hypothesized to be reduced.

In fact, Jelinek et al. [30] and Ching, Goh, and Tan [34] have used various paradigms to gather evidence supporting the underlying mechanism of association splitting. For instance, Ching et al. [34] recruited 142 Singaporean college students (106 females and 36 males) and instructed them to memorize word lists, each for an immediate recognition task. Participants were presented with different 10-item lists of contamination-relevant, negatively valenced (but contamination-irrelevant), and neutral words, respectively. Words in each list were semantically related to their own unpresented word (i.e., critical lure). In other words, words in a contamination-relevant list were semantically related to a single unpresented contamination-relevant word, and so on. Previous research has shown that people tend to falsely recognize critical lures (i.e., wrongly say that critical lures were previously presented in the lists) [28, 35]. Additionally, participants were randomly assigned and instructed to process the meaning of each word in either a relational or item-specific manner while memorizing them. In the former condition, participants had to think of the meaning of, for example, a contamination-relevant word that related it to other contamination-relevant words, and was intended to simulate an obsessive processing of the words in question. In the latter condition, the item-specific semantic processing instructions required participants to think of a unique meaning or creative use of each word that differentiated it from other words. This was intended to simulate the technique of association splitting as applied to the words in question. Results indicated substantially lower rates of false recognition of all types of critical lures (i.e., more accurate rejection of all types of critical lures) with simulated association splitting. This was evidence that limited activation energy had been divided more thinly along the additional associations created during simulated association splitting, as the technique purports to do.

Currently, no systematic review of the efficacy of association splitting for reducing OCD symptoms exists in the literature. As such, we aim to supplement this gap by reviewing studies that have examined this question. The goal of this systematic review is to provide recommendations on how to refine future research on the efficacy of association splitting for reducing OCD symptoms. Our specific aims in this systematic review are to:

- Summarize and compare outcomes of association splitting for OCD symptoms across different studies.
- Identify and discuss potential pragmatic advantages that association splitting, as a self-help tool, pos-
sesses in being able to reach clients from underserved populations who face barriers to face-to-face CBT for OCD.

- Consider methodological, cultural, and ethical factors in evaluating reviewed studies, and discuss how these considerations can be incorporated into future research and clinical applications of association splitting for OCD.

2. METHOD

2.1. Study Inclusion Criteria

We defined study inclusion criteria using a PICOS scheme, as adapted from Riva, Malik, Burnie, Endicott, and Busse [36]. Essentially, we included only studies that reported data on adults with OCD symptoms (P = Population) who received association splitting (I = Intervention), compared to an active (i.e., psychological, pharmacological, or combined psychopharmacological treatment) or non-active control group (e.g., standard treatment, placebo, waitlist) or no control group at all (C = Comparison), and which measured the severity of OCD symptoms as an outcome (O = Outcome). In terms of study design, only studies with a pre-post design were included (S = Study Design), to indicate change due to intervention.

2.2. Search Strategy and Study Selection

We performed an intensive literature search using the following electronic databases for peer-reviewed scientific articles published before December 2018 that were written in either the English or German language (given language proficiencies of the review team): MEDLINE; PsycINFO; ISI Web of Science; Cochrane Central Register of Controlled Trials (CENTRAL). As we aimed to maximize the sensitivity of our searches, we used the Boolean search terms of “OCD” OR “Zwangsstörung” AND “association splitting” OR “Assoziationsspaltung.” Moreover, we checked the reference lists of all included articles, and further searched clinical trial registries through the World Health Organization’s International Clinical Trials Registry Platform (ICTRP) and ClinicalTrials.gov. Results (titles and abstracts) were screened independently by two reviewers (the first and second authors), and consensus was reached with regard to eventual article inclusion.

2.3. Data Synthesis

To synthesize data from included articles, we provided a chronological summary of each study. For each study, we described participant demographics and methodological details, followed by the main efficacy findings.

3. RESULTS

Fig. (1) presents the PRISMA diagram showing the steps followed from initial identification to the final inclusion of studies for review. Our initial search retrieved 71 records. After duplicates were removed (n = 30), the remaining 41 records (titles and abstracts) were screened against our study inclusion criteria, resulting in the exclusion of another 35.
Table 1. Characteristics of studies included in the systematic review.

<table>
<thead>
<tr>
<th>Study</th>
<th>Intention-to-treat Sample</th>
<th>Mode of Administration of Association Splitting</th>
<th>Language of Association Splitting Manual</th>
<th>Control Group</th>
<th>Outcome Measures</th>
<th>Time between Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moritz et al. (2007)</td>
<td>Self-reported OCD (n = 30)</td>
<td>Self-help</td>
<td>German</td>
<td>None</td>
<td>MOCI; Y-BOCS-SR</td>
<td>3 weeks</td>
</tr>
<tr>
<td>Moritz &amp; Jelinek (2011)</td>
<td>Self-reported OCD (n = 46)</td>
<td>Self-help</td>
<td>English</td>
<td>Waitlist</td>
<td>OCI-R; Y-BOCS-SR</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Rodríguez-Martin et al. (2013)</td>
<td>Non-clinical college students experiencing unwanted intrusions (n = 49)</td>
<td>Self-help, modified for intrusions</td>
<td>Spanish</td>
<td>Waitlist</td>
<td>WBSI</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Moritz &amp; Russu (2013)</td>
<td>Self-reported OCD (n = 72); subset of 60 subsequently confirmed for OCD diagnosis</td>
<td>Self-help</td>
<td>Russian</td>
<td>Waitlist</td>
<td>Y-BOCS-SR; OCI-R</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Ching &amp; Williams (2018)</td>
<td>Non-clinical college students (n = 120)</td>
<td>Self-help, modified for SO-OCD symptoms</td>
<td>English</td>
<td>Waitlist</td>
<td>SORT; SIT; WBSI</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Jelinek et al. (2018)</td>
<td>Patients with OCD (n = 109)</td>
<td>Therapist-assisted</td>
<td>German</td>
<td>Cognitive remediation</td>
<td>OCI-R; Y-BOCS</td>
<td>4 weeks; 6 months</td>
</tr>
</tbody>
</table>

Note. MOCI = Maudsley Obsessive Compulsive Inventory; Y-BOCS-SR = Yale-Brown Obsessive-Compulsive Scale - Self-Report Version; Y-BOCS = Yale-Brown Obsessive-Compulsive Scale - Clinician-Administered Version; WBSI = White Bear Suppression Inventory; OCI-R = Obsessive-Compulsive Inventory-Revised; SORT = Sexual Orientation Obsessions and Reactions Test; SIT = Sexually Intrusive Thoughts Scale.

3.1. Sample and Intervention Characteristics

In total, 426 participants were included, ranging from 30 to 120 participants per study, with mean sample ages ranging from 20.08 to 36.15 years, and gender distribution of 26.5% to 45.8% of males. Two studies recruited non-clinical college students (one study specifically recruited non-clinical college students experiencing unwanted intrusions), three studies recruited internet respondents self-reporting OCD symptoms identified from a large checklist, while in the latter, participants peruse examples of different types of obsessions and compulsions prior to responding. The MOCI and OCI-R are self-report measures of different OCD symptoms, including checking, washing, doubting, and ordering. The SORT and SIT assess sexual obsessions in OCD, with the former more specifically assessing sexual orientation-related obsessions and compulsions (e.g., obsessions that one’s sexual orientation will change against one’s will, as well as compulsive somatic checking). Lastly, the WBSI assesses thought suppression tendencies, a construct shown to contribute to the development of obsessions in OCD [45]. All of these measures have demonstrated good psychometric properties in their respective cited studies.

3.2. Outcome Measures

Table 1 also displays the OCD-related outcome measures used in each of the six studies. These were: the clinician-administered version of the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) [37, 38] and its self-report version (Y-BOCS-SR) [39]; the Maudsley Obsessive Compulsive Inventory (MOCI) [40]; the Obsessive-Compulsive Inventory-Revised (OCI-R) [41]; the Sexual Orientation Obsessions and Reactions Test (SORT) [42]; the Sexually Intrusive Thoughts Scale (SIT) [43]; as well as the White Bear Suppression Inventory (WBSI) [44]. The Y-BOCS and Y-BOCS-SR, both assess the severity of obsessions and compulsions as a total score, differing only in their format of administration; in the former, the clinician assesses the severity of obsessions and compulsions as a total score, differing only in their format of administration; in the latter, participants peruse examples of different types of obsessions and compulsions prior to responding. The MOCI and OCI-R are self-report measures of different OCD symptoms, including checking, washing, doubting, and ordering. The SORT and SIT assess sexual obsessions in OCD, with the former more specifically assessing sexual orientation-related obsessions and compulsions (e.g., obsessions that one’s sexual orientation will change against one’s will, as well as compulsive somatic checking). Lastly, the WBSI assesses thought suppression tendencies, a construct shown to contribute to the development of obsessions in OCD [45]. All of these measures have demonstrated good psychometric properties in their respective cited studies.

3.3. Chronological Summary of Association Splitting Efficacy

Moritz et al. [29] first tested the efficacy of association splitting for reducing OCD symptoms via an internet-based, self-help intervention protocol. Thirty-eight individuals with self-reported OCD were recruited from specialized online OCD discussion forums to complete an online survey containing measures of OCD symptoms (i.e., the MOCI and Y-BOCS-SR) and depressive symptoms (i.e., the Beck Depression Inventory [BDI]) [46, 47]. The researchers then emailed...
the association splitting manual to participants, checking in regularly about their practice of the technique. The manual first introduces participants to the theoretical background of the technique (e.g., explaining what semantic networks are), then applies principles of the technique to obsessions using illustrations. In the second half of the manual, instructions for how to practice association splitting (e.g., identifying two to three concepts/words at the core of their obsessions, generating new non-OCD-relevant associations that are positive and possibly humorous, practicing for 10 minutes daily during obsessions-free intervals) are provided. Three weeks later, participants were emailed a link to complete the same online survey, yielding a response rate of 84.2%.

Intention-to-treat (ITT) analyses with 30 participants indicated that 33% of participants reported substantial subjective symptom relief from association splitting, which was corroborated by a clinically significant symptom decline of 35% or more on the Y-BOCS-SR total score ($d = .58$). A decline of 25% in Y-BOCS-SR scores is considered minimum required to be considered as a clinically significant treatment response, as determined in trials for Ex/RP [17, 18]. The ITT sample also reported significant reductions on all but one subscale of the MOCI, with small-to-medium effect sizes ($ds = .29-.48$). Per protocol (PP) analyses (i.e., analyses only of data from participants who adhered to the intervention and completed follow-up measures without major deviation from the protocol) [48] with 24 participants showed a treatment response rate of 42%. Furthermore, 77% of the 30 participants from the ITT sample felt that the technique was easy to practice, 93% easily comprehended the manual instructions, and 86% were interested in continuing to practice association splitting to cope with their OCD symptoms.

Moritz and Jelinek [49] conducted a replication study, recruiting participants self-reporting an OCD diagnosis from a wider variety of English-speaking online outlets (e.g., OCD internet forums, online OCD support groups, and websites of OCD organizations). Forty-six participants were equally and randomly assigned to either the association splitting or waitlist control group. Participants first completed the baseline online survey consisting of the OCI-R, Y-BOCS, and BDI. The association splitting manual was then emailed to participants in the association splitting condition. The manual used in the study by Moritz et al. [29] was translated into English, using the same instructions and protocol for participants to practice association splitting. Questions about the application of the technique were promptly clarified via email whenever necessary. Four weeks later, participants completed the same online survey, with a response rate of 74%.

Once again, association splitting was moderately efficacious in reducing OCD symptoms. PP analyses indicated that there was a clinically significant decline of 25% in overall scores on the Y-BOCS-SR (especially on the obsessions and resistance subscales), with medium-to-large effect sizes in the association splitting group, compared with the waitlist control group ($ds = .69-.94$). Association splitting also had a positive impact on BDI (approximately 33% reduction) and OCI-R obsessions subscale scores (reduction of approximately two points), again, with medium-to-large effect sizes ($ds = .71$ and .76, respectively). Similar findings were observed with ITT analyses. Importantly, these findings were obtained with completers who had more severe OCD symptoms at baseline than non-completers. Subjective opinions of the technique in completers in the association splitting group were also generally favorable, with 82% expressing interest in continuing to practice the technique in the future.

Rodríguez-Martín, Moritz, Molerio-Pérez, and Gil-Pérez [50] examined the efficacy of association splitting for reducing unwanted intrusive thoughts and the tendency to maladaptively suppress these thoughts (i.e., risk factors for the development of OCD) in 49 non-clinical community participants who were experiencing regular unwanted intrusions in Cuba. Participants were randomly assigned to the association splitting or waitlist control group, with no differences in demographic characteristics or prevalence of unwanted intrusions between the groups. The association splitting manual used here was the same as that used in the studies by Moritz et al. [29] and Moritz and Jelinek [49], except the researchers first translated the association splitting manual to Spanish, and then modified the contents to focus on unwanted intrusive thoughts instead of more severe obsessions. In this version of the manual, the researchers also included more psychoeducational information on the prevalence of unwanted intrusions in the general population, the maladaptive method of suppressing obsessive thoughts as a way of controlling obsessions, as well as the paradoxical effects of thought suppression (i.e., how thought suppression leads to a rebound effect in increased obsessions). Instructions on how to practice association splitting were the same as those given by Moritz et al. [29] and Moritz and Jelinek [49]. The WBSI was used to assess changes in unwanted intrusions and thought suppression after a two-week interval. Compared with the waitlist control group, association splitting significantly reduced unwanted intrusions and thought suppression by 8.9% and 13.7%, respectively, with medium-to-large effect sizes (partial $\eta^2 = .17$ and .22). Additionally, all participants who received association splitting viewed the technique as effective, reporting benefits on average just six days after implementing the technique.

Moritz and Russu [51] recruited 72 Russian-speaking participants with self-reported OCD over the internet. Invitations for participation were posted on several Russian-speaking internet services and discussion forums. Inclusion criteria were age between 18 and 65, self-reported presence of obsessive thoughts (a definition was provided), self-reported (i.e., at least partial) insight into the exaggerated nature of the disorder, and consent to participate in two anonymous, internet-based surveys that were four weeks apart, leaving sufficient time in between to practice association splitting. OCD diagnoses were either confirmed by a psychiatrist ($n = 30$), a psychologist ($n = 16$), a psychotherapist not further specified ($n = 10$), or a neuropathologist ($n = 4$). In 12 cases, OCD was self-diagnosed. According to a self-report, 25% of the samples were currently taking medication, and only 47% had previously received any kind of treatment for OCD. Participants completed the Y-BOCS-SR, OCI-R, and BDI, and were randomly allocated to self-administered association splitting ($n = 36$) or waitlist ($n = 36$). The treatment manual was then sent to participants in the experimental group via email. Participants in the waitlist condition were informed via email that they were allocated to the control group and would receive the manual subse-
quent to post-assessment. Four weeks later, 48 participants (67% of the baseline sample) completed the post-assessment with the same self-report instruments. Completers and non-completers did not differ on demographic or psychopathological variables (all ps > 0.1).

ITT analyses (using multiple imputations for missing values) showed a medium-to-large effect size for the Y-BOCS-SR total score (partial $\eta^2 = .13$) in favor of the association splitting group, relative to the waitlist control group. Medium-to-large effect sizes also emerged for the OCI-R, with significant reductions in terms of the total score (partial $\eta^2 = .19$), as well as on the neutralizing (partial $\eta^2 = .10$), obsessing (partial $\eta^2 = .18$), and washing subscales (partial $\eta^2 = .15$). Moreover, association splitting showed a significant effect on depressive symptoms as assessed by the BDI (partial $\eta^2 = .16$). Reliable change - according to Jacobson and Truax [52] - based on Y-BOCS total score was significantly higher in the association splitting group (53%), compared to the waitlist control group (17%). Finally, 83% of the participants in the association splitting group affirmed that their OCD symptoms decreased due to association splitting practice, and a large majority of these participants found the manual to be comprehensible, useful, and written in an appealing way.

Recently, Ching and Williams [53] tested the efficacy of association splitting for improving biased semantic networks and symptoms specifically relevant to sexual orientation-OCD (SO-OCD) in non-clinical college students. Symptoms of SO-OCD include obsessive fears of one’s sexuality changing against one’s will [54, 55], typically accompanied by compulsive reassurance-seeking and checking for sexual arousal around others [56-58]. This study is the first in the association splitting research program to examine a specific OCD symptom dimension. One hundred and twenty healthy undergraduates were randomly assigned to either the association splitting or waitlist control group. Participants completed baseline and four-week follow-up measures of SO-OCD symptoms (i.e., SORT), sexual obsessions (i.e., SIT), and thought suppression (i.e., WBSI), as well as an association task in which they generated associations to SO-OCD-relevant, negatively valenced, and neutral cue words. Specifically, participants were instructed to generate semantic associations (e.g., nouns, verbs, or adjectives) with different meanings, rhymes, or associative chains (i.e. relating associations to one another) that spontaneously come to their minds to the cue words presented. Immediately after baseline assessment, participants in the association splitting group received a version of the association splitting manual modified for SO-OCD concerns via email, with instructions to familiarize themselves with the contents and engage in daily 10-min practice as instructed in the manual until the follow-up assessment. Brief weekly check-ins via phone calls were made to ensure that participants were adhering to association splitting practice. Participants in the waitlist control group were simply reminded (with phone calls at the same frequency) to return for the follow-up assessment. At four-week follow-up, participants in the association splitting group were also asked about adherence to association splitting practice (i.e., number of days missed), percentage of association splitting practice that focused on SO-OCD-relevant concerns (i.e., 0-100%), and perceived utility of association splitting for addressing SO-OCD-relevant concerns (i.e., on a 0-100 visual analog scale). In the SO-OCD-specific association splitting manual, the core presentation structure and instructions on how to practice the technique were retained from the original version, with only the content modified to focus on sexual orientation obsessions. For example, the manual emphasized SO-OCD-relevant concepts (e.g., ‘gay’), and provided SO-OCD-irrelevant associations as examples (e.g., ‘gay’ $\Rightarrow$ ‘day’ [rhyme]; ‘gaze’ [similar phonetics]; ‘happy’ [positive synonym]).

Compared with waitlist controls, there were significant reductions in SO-OCD-relevant and negative SO-OCD-irrelevant associations ($d$s = 0.3-0.6), and increases in positive and neutral SO-OCD-irrelevant associations ($d$s = 1.73 and 3.88, respectively), in the association splitting group. There were also significant reductions in SO-OCD symptoms ($d$ = 0.76), sexual obsessions ($d$ = 0.38), and thought suppression ($d$ = 1.07) after association splitting. Although the intervention gains were impressive (especially compared to studies above), they were expected since the sample was a non-clinical one. Nonetheless, participants who responded to association splitting (91.7% of participants in the association splitting group) adhered well to daily practice and largely perceived association splitting to be helpful for addressing potential SO-OCD concerns. These findings indicate that association splitting can be a helpful and well-received technique to support SO-OCD symptom reduction, given that these symptoms tend to respond poorer to Ex/RP compared with, e.g., contamination symptoms [21, 22].

More recently, Jelinek, Hauschildt, Hottenrott, Kellner, and Moritz [59] investigated the efficacy of therapist-assisted association splitting (compared with the control add-on intervention of computerized cognitive remediation) as an adjunct to standard CBT for OCD. One-hundred-and-nine patients with OCD were recruited from an intensive inpatient program and randomly assigned to either the CBT-plus-association splitting or CBT-plus-computerized cognitive remediation group. At baseline, all patients provided responses on measures of OCD (Y-BOCS; OCI-R) and depressive symptoms (i.e., Hamilton Depression Rating Scale [HDRS]) [60]. Thereafter, all patients received the add-on intervention (i.e., association splitting or computerized cognitive training) administered over six 50-min sessions on a twice-weekly basis for three weeks, in addition to CBT for OCD. Patients in the CBT-plus-association splitting group were familiarized with the technique for the first two sessions, then were instructed on how to apply the technique to their individual OCD symptoms for the next four sessions. Patients in the CBT-plus-computerized cognitive training group engaged in training aimed at improving attention span, visuomotor skills, and working memory for the entirety of the six sessions. The same psychopathology measures were administered after 4 weeks, and again after 6 months, for all patients.

In the study, feasibility and patients’ acceptance of therapist-assisted association splitting were good, and over 90% of the patients stated that they would recommend association splitting to others, compared with only 39% in the cognitive remediation group. Moreover, 40-50% of the patients who received association splitting confirmed that their OCD
symptoms improved due to the intervention, and none of the patients experienced any adverse events. In the primary analyses, the overall improvement of OCD symptoms was similar in both add-on intervention groups. However, secondary analyses showed a larger decrease in avoidance behavior from baseline to 6 months follow-up in the association splitting group (partial $\eta^2 = .05$). Moreover, when contagion effects were accounted for (i.e., excluding 17 patients in the cognitive remediation group who had obtained information about association splitting, e.g., from other patients in the association splitting group or the internet), improvements in overall symptom severity from baseline to 4 weeks (partial $\eta^2 = .07$), and from baseline to 6 months (partial $\eta^2 = .06$), were greater in the association splitting group than in the cognitive remediation group.

4. DISCUSSION

When applied as a self-help intervention, association splitting appears to be efficacious in reducing both overall OCD symptom severity [29, 49, 51], specific OCD symptoms (i.e., sexual obsessions and SO-OCD symptoms) [53], as well as subclinical unwanted intrusive thoughts [50], with small-to-large effect sizes, in different clinical and non-clinical samples. The technique was also efficacious in reducing the use of an important maladaptive coping strategy implicated in the maintenance of OCD symptoms (i.e., thought suppression) in OCD analog [50] and college samples [53]. Furthermore, in support of its underlying mechanism, association splitting was also efficacious in weakening biased OCD-relevant semantic networks [53] (see also studies by Ching et al. [34] and Jelinek and colleagues [30, 31]).

However, when used as an add-on intervention to CBT and compared to an active control intervention (i.e., cognitive remediation), results were less clear [59]. Although superior adjunct effects of association splitting could not be shown for the primary outcome (decrease of Y-BOCS total score), they were observed for secondary parameters (decrease of avoidance behavior after 6 months) and subjective outcomes (superior subjective appraisal ratings, higher attendance rates). When contagion effects were accounted for, superior symptom decline was observed for association splitting as an add-on, compared with cognitive remediation. Nonetheless, Jelinek et al. [59] concluded that the effects of the baseline intervention (CBT) may have been too strong to detect any additional effect of therapist-assisted association splitting. Therefore, more studies (e.g., testing the effect of therapist-assisted association splitting as a stand-alone intervention) are needed before further conclusions about association splitting’s efficacy in this setting can be drawn.

Across all reviewed studies, association splitting was also well-received by users, whether in terms of ease of use and comprehension of the manual, reported adherence to daily practice, perceived utility of the technique for addressing OCD concerns, or reported intention to continue the use of the technique to cope with OCD symptoms. The acceptability of AS might make it a good adjunct in first reducing OCD symptom severity in preparation for therapy when clients are not yet willing to embark on challenging Ex/RP exercises.

4.1. Potential Pragmatic Advantages of Association Splitting

Several obstacles persist in the treatment of OCD. Treatment adherence can be problematic with CBT, which is an important concern, given that high adherence is a strong predictor of optimal outcomes [61-63]. According to the meta-analysis by Öst et al. [11], treatment dropout is estimated at 11.4% for CT, and even higher at 19.1% for Ex/RP. A more recent review by Ong et al. [20] indicated a weighted average dropout rate of 14.7% in Ex/RP for OCD. In their review of various anxiety disorders (including OCD), Santana and Fontenelle [64] emphasized the role of cognition (e.g., attitudes toward treatment) as a crucial factor for intervention, suggesting that willingness to engage in challenging exposure exercises integral to Ex/RP may be important (see also Külz et al. [65]). Other studies also suggest that approximately 25% of patients with OCD are not willing to start Ex/RP, due to the challenging nature of exposure exercises [19]. Ex/RP may also be less successful in treating obsessions, compared with compulsions [29], especially when they are of an unacceptable/taboo nature, due to provider inexperience. These are significant reasons to explore adjunct treatment options that can possibly circumvent the aforementioned limitations of CBT.

Association splitting can be useful in the initial help-seeking phase to boost subsequent treatment success in face-to-face therapy [66]. Mataix-Cols and Marks [67] proposed a stepped-care model for OCD, in which individuals progress from computer-/manual-assisted self-help for symptoms, to having brief phone assistance for how to implement self-help techniques, to brief, spaced face-to-face guidance for technique implementation, to intensive face-to-face psychotherapy. Therefore, as the first step in a stepped-care model for OCD, association splitting can be useful in correcting patients’ misconceptions about their symptoms and psychotherapy in general, thereby motivating them to seek more intensive mental health treatment later on [68].

Even so, state-of-the-art CBT for OCD can be difficult to access [69]. Taylor, Abramowitz, and McKay [70] documented the negative influences, among others, of practical barriers (e.g., low socioeconomic status, cost, demands on time, lack of health insurance, transportation difficulties) on access and adherence to CBT for various anxiety disorders, including OCD. Besides reducing OCD symptoms, association splitting can also be helpful when face-to-face CBT for OCD is unavailable. For example, association splitting, as a freely available self-help tool, can provide some symptom relief at no financial cost despite financial difficulties, the lack of affordable healthcare and related subsidies, and poor accessibility to specialized OCD treatment [71, 72]. Stigma about mental illness is another significant barrier to face-to-face OCD treatment, particularly with unacceptable/taboo obsessions, leading to concealment out of shame and embarrassment, or the fear of involuntary hospitalization [73, 74]. Unacceptable/taboo forms of OCD also tend to be improperly assessed and treated, in turn increasing clients’ mistrust of psychological services [66] and their fear of being wrongly diagnosed with more stigmatizing labels (e.g., “schizophrenia” or “pedophilic disorder”) [75], particularly for ethnic/minority sufferers [76]. The association split-
tting manual, written in normalizing, non-pathologizing language, can facilitate a positive self-help experience for these individuals who might not report, seek, or receive proper treatment for such concerns [77].

4.2. Methodological Considerations

There are several areas for improvement in extant intervention research on association splitting. First, the efficacy studies cited were slightly inconsistent in including a control group. To be specific, the study evaluating association splitting by Moritz et al. [29] did not include a waitlist control group, making it impossible to conduct definitive RCT comparisons of the efficacy of association splitting in reducing OCD symptoms. More importantly, the studies reviewed did not uniformly recruit patient samples with OCD, appropriate control intervention groups, and/or clinical control groups diagnosed with anxiety disorders. As such, it was difficult to accurately examine the efficacy of association splitting in participants actually diagnosed with OCD, incremental efficacy of association splitting beyond a control treatment (i.e., standard CBT), or specific efficacy for OCD symptoms beyond anxiety in general. For example, Moritz et al. [29], Moritz and Jelinek [49], and Moritz and Russu [51] neither conducted diagnostic interviews to verify participants’ self-reported OCD status nor recruited anxiety control groups. Additionally, although Jelinek et al. [59] recruited patients with OCD, they did not include a CB-T-only group to examine whether there would be incremental reductions in OCD symptoms attributable to association splitting as an add-on intervention. Furthermore, Rodríguez-Martin et al. [50] and Ching and Williams [53] randomly assigned non-clinical college students to intervention or waitlist control groups, instead of recruiting diagnosed patient samples with OCD and anxiety-disorders control groups. Therefore, future studies on association splitting should attempt to recruit appropriate populations and control groups for rigorous tests of efficacy and specificity for OCD.

Next, five of the studies reviewed examined the efficacy of association splitting when administered as a self-help technique, while only one implemented association splitting in a therapist-assisted adjunct to CBT. More studies with the latter mode of administration should be conducted, in addition to studies that first disseminate association splitting as a self-help tool prior to recruitment into CBT trials to determine if association splitting practice can be incorporated and maintained in face-to-face therapy. These findings would be informative as to the extent to which association splitting could be optimally integrated into conventional CBT for OCD (e.g., assigning association splitting practice as homework, with reiterative refinement in session).

Post-intervention assessments for the studies reviewed occurred from as brief as two weeks [50] to six months after baseline assessment [59]. However, none of these studies tracked the durability of intervention gains beyond six months after baseline assessment. As such, future research should also aim to examine the long-term effects of association splitting on OCD symptom reduction, with longitudinal assessment to determine whether intervention gains are maintained from the post-intervention to long-term follow-up intervals (e.g., 12 months). An important consideration implicit in such longitudinal research is whether participants continue to practice association splitting to maintain or boost gains.

Another important methodological consideration (and direction for future research on association splitting) is examining differential efficacy for different OCD symptom dimensions. Most of the efficacy studies mentioned did not examine effects on different OCD symptom dimensions or intrusive thought categories. For the latter, Rodríguez-Martin et al. [50] classified participants’ intrusions only into “family issues” (e.g., intrusive thoughts about harm coming to a family member), “couple issues” (e.g., intrusive thoughts about a romantic partner cheating), and “other issues,” precluding conclusions of whether association splitting was helpful in reducing different types of unwanted thoughts in OCD. In fact, the study by Ching and Williams [53] was the only one to examine the efficacy of association splitting for symptoms of a specific form of OCD revolving around sexual orientation concerns. However, more research is needed on whether the prevalent and broader OCD symptom dimensions of contamination fears, responsibility for harm, symmetry/ordering/“just right” concerns, and unacceptable/taboo thoughts respond similarly to the technique. On a related note, given the role of dysfunctional beliefs about obsessive thoughts in maintaining OCD symptoms [8, 9], future research should also examine the effects of association splitting on such beliefs.

Lastly, all of the studies reviewed, except for Ching and Williams [53], did not measure changes in semantic networks that were hypothesized to drive OCD symptom reduction (for an excluded study supporting OCD semantic network alterations due to association splitting, see Jelinek et al. [30]). Even in the study by Ching and Williams [53], the authors did not explore additional, corroborating means of measuring changes in semantic networks. Therefore, future association splitting efficacy research should attempt to devise and/or include additional means of assessing alterations in the strength of semantic associations in OCD-relevant networks, as proof of mechanistic change. The psycholinguistics literature contains many promising paradigms, tasks, and measures that, if used, can allow for interpretations to converge on association splitting working as purported at the semantic network level. Among several others, tasks and measures that can be used alongside the association task include assessing changes in performance on immediate or delayed recognition or recall of semantically related, OCD-relevant words [34]. Future studies can also use semantic priming to see if there are increases in reaction time in responding to whether subsequently presented OCD-relevant words are related to initially presented OCD-relevant prime words (i.e., a sign of weakening of biased, OCD-relevant semantic associations) [78].

4.3. Cultural, Age and Linguistic Considerations

Although the studies reviewed recruited internationally, most of them did not collect or report information on the ethnoracial makeup of their samples. Studies have demonstrated ethnoracial differences in OCD symptom manifestation (e.g., African Americans showing elevated contamination concerns, compared with European Americans) [79, 80],
which raises the question of whether association splitting can be equally helpful for certain OCD symptoms across ethnoracial groups. To address this, future studies could supplement the initial symptom information section of the association splitting manual to capture possible cultural differences in manifestations of OCD. Likewise, the efficacy of association splitting has been examined only in adult populations, and is likely to work optimally only when users can adequately comprehend and apply concepts and instructions in the self-help manual. Therefore, it would be interesting to examine whether the manual and technique can be modified to cater efficaciously to individuals of different developmental ages, such as children with OCD who read at lower levels, and whether association splitting practice can be guided in a comprehensible way in face-to-face therapy for these individuals. Furthermore, although the association splitting manual has been translated into various languages (i.e., German, English, Spanish, Russian), efficacy research has not been equitably conducted for each of these languages. It is possible for semantic networks to be shaped differently depending on the linguistic culture they were constructed in. For example, semantic networks may vary in density and/or a variety of speech components (nouns, verbs, adjectives, etc.) between English and non-English speakers, or between monolingual individuals and individuals who are at least bilingual. Thus, it is pertinent to examine whether association splitting, in its various translations, can be equally efficacious for OCD sufferers of different native tongues.

It might be interesting to further expound how association splitting can be useful for ethnoracial minorities with OCD. Williams et al. [81] showed that everyday racial discrimination (i.e., racial microaggressions, or subtle, interpersonal daily hassles and insults based on one’s ethnoracial identity; e.g., receiving inferior service or being treated with less respect/courtesy, or being unfairly followed in stores) uniquely predicted increased odds of suffering from various types of obsessions and compulsions (e.g., contamination concerns, unacceptable thoughts, washing and checking compulsions, etc.) in a large national sample of African American respondents. The authors discussed the possible clinical implication that therapists might, via their racial microaggressions towards clients of color, impede productive and successful OCD treatment. The authors explained that therapists’ racial microaggressions against clients of color might reduce the amount of mental resources clients have left to engage in challenging Ex/RP work, due to the depletion of limited resources in trying to cope with racial microaggressions. This might also explain why there is poor minority inclusion in RCTs of CBT for OCD (and other anxiety disorders) [82, 83]. Clients of color, whether based on negative past personal experiences with racial microaggressions or negative preconceived notions about therapy with White clinicians, can be deterred from seeking treatment. This coheres with research showing how stigma against mental illness, mistrust of psychological services, and fear of being wrongly diagnosed with stigmatizing labels, are salient help-seeking concerns for Asian Americans [84], Latino Americans [85], and African Americans [72, 86].

In light of these barriers to treatment, it makes sense to disseminate association splitting as a cost-free and readily available self-help tool for individuals with OCD, particularly those in disenfranchised groups, who might not report, seek, or receive proper treatment for such concerns [77]. Association splitting might be helpful for these individuals because the self-help nature of the technique allows ethnoracial minorities with OCD to gain some symptom relief in the absence of potentially damaging racial microaggressions from therapists, while they attempt to locate a culturally sensitive/competent treatment provider and/or a clinician of color, etc. Additionally, when clients of color read the association splitting manual, they come into contact with psychoeducational information (e.g., different OCD symptom dimensions, as well as the semantic network approach which is based on simple learning principles) that communicates to them that their OCD is highly changeable and does not stem from an “inner evil,” challenging some of the internalized stigmas that these individuals can have about their obsessions. This normalization of their OCD can perhaps better motivate ethnoracial minorities to subsequently seek face-to-face treatment, consistent with a stepped-care approach [67]. Regardless, to test these questions about efficacy and acceptability of association splitting for OCD in different ethnoracial groups, future studies should attempt to increase ethnoracial minority inclusion via culturally attuned recruitment methods (for details, see Williams, Tellawi, Wetterneck, & Chapman [87]).

4.4. Ethical Considerations

When treatment is delivered solely by way of a self-help manual (as with the majority of the studies reviewed here), no personalized feedback from therapists is possible. This can be a potential ethical issue when clients begin to detract from the intended use of association splitting and end up causing more harm than good to themselves by exacerbating their OCD symptoms. For example, users might be tempted to turn association splitting practice into a compulsion (i.e., practicing association splitting in response to the onset of obsessions, thereby deploying association splitting as a compulsion). To prevent this from happening, there are clear instructions in the manual for users to practice association splitting only outside of intervals in which one is experiencing obsessions, accompanied by cautionary and psychoeducational information that doing so will be detrimental to their improvement. While there are no means of monitoring this in actual practice once users have downloaded the manual, it is hoped that users will find some symptom relief and sufficiently internalize the destigmatizing messages contained within about their OCD to feel empowered to seek face-to-face psychotherapy for continued symptom improvement.

However, the concern remains that for individuals with more severe OCD symptom severity, the use of self-help approaches might detract from spending time and effort in perhaps more appropriate and “stepped-up” interventions in face-to-face treatment [88]. Also, despite association splitting being emphasized as only an adjunctive treatment option, users who do not respond to association splitting might conclude that treatment does not work for them, without having tried a first-line treatment (i.e., CT, Ex/RP). Additionally, what happens when users are overwhelmed and/or are in suicidal distress/crises/emergencies due to obsessions?
Research has shown violent obsessions to be uniquely predictive of suicidality in non-clinical college students [89]. Surprisingly, the association splitting manual makes no indication to include distress hotline numbers in its various translations, other than a note for users to seek expert psychological help for more serious OCD symptoms. All of these ethical considerations should be addressed in future scientific and professional work related to the study and use of association splitting (e.g., supplementing the manual with up-to-date, local and global emergency resources).

CONCLUSION

In this article, we have reviewed studies that examined the efficacy of association splitting, whether administered as a self-help or therapist-assisted technique, for reducing OCD symptoms, subclinical unwanted intrusions, and the related construct of thought suppression. Even though there has been more than a decade of research into association splitting, extant efficacy research is limited, and association splitting remains a novel cognitive adjunct tool for CBT for OCD. However, the studies reviewed here do indicate that association splitting can efficaciously reduce OCD symptoms when used as a self-help intervention. Self-help association splitting also appears to be useful in providing some care—rather than no care—by circumventing attitudinal or structural barriers to face-to-face psychotherapy. Nonetheless, much empirical research remains to be done in terms of, broadly, verifying the incremental utility of this novel cognitive addition to CBT for OCD, while also exploring whether, for example, there might be cultural variations in receptivity to this addition to OCD treatment. Thus, future research should incorporate our suggested methodological, cultural, and ethical considerations in rigorous tests of the efficacy, acceptability, and ease of administration of association splitting among diverse groups. We hope that the suggestions given in this review can provide helpful starting points for more research geared toward these goals.

CONTRIBUTORS

All authors contributed to the conception and design of this project. The first and second authors conducted the initial literature searches, as well as subsequent screening and final selection of studies. The first author synthesized findings from reviewed studies and produced the initial draft of the manuscript. All authors contributed to the final version of the manuscript.

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