A systematic review and evaluation of inhibitory stimulus control procedures as a treatment for stereotyped behavior among individuals with autism

Sinéad Lydon, Laura Moran, Olive Healy, Teresa Mulhern & Kerie Enright Young

To cite this article: Sinéad Lydon, Laura Moran, Olive Healy, Teresa Mulhern & Kerie Enright Young (2016): A systematic review and evaluation of inhibitory stimulus control procedures as a treatment for stereotyped behavior among individuals with autism, Developmental Neurorehabilitation, DOI: 10.1080/17518423.2016.1265604

To link to this article: http://dx.doi.org/10.1080/17518423.2016.1265604

Published online: 23 Dec 2016.

Article views: 16

View related articles

View Crossmark data
A systematic review and evaluation of inhibitory stimulus control procedures as a treatment for stereotyped behavior among individuals with autism

Sinéad Lydon¹, Laura Moran², Olive Healy², Teresa Mulhern³, and Kerrie Enright Young⁴

¹Discipline of General Practice, National University of Ireland, Galway, Co. Galway, Ireland; ²School of Psychology, Trinity College Dublin, Co. Dublin, Ireland; ³School of Psychology, National University of Ireland, Galway, Co. Galway, Ireland

Abstract

Purpose: Stereotypy is pervasive among persons with autism and may impact negatively on social inclusion and learning. The implementation of resource-intensive behavioral interventions to decrease these behaviors has been questioned. Inhibitory stimulus control procedures (ISCPs) comprise a type of antecedent-based intervention that has been proposed as an effective treatment approach for stereotypy but has received limited research attention to date. Method: The current systematic review sought to examine and synthesize the literature reporting applications of ISCPs in the treatment of stereotypy among persons with autism. Treatment outcomes were analyzed quantitatively and the status of ISCPs as evidence-based practice was evaluated in accordance with the National Autism Center’s National Standards Report guidelines. Results: A total of 11 studies were reviewed with results indicating that ISCPs constituted an emerging treatment for the stereotypy exhibited by persons with autism. Conclusions: ISCPs comprise a promising intervention for stereotyped behavior but further research is required.

Restricted, repetitive, and stereotyped behaviors, often referred to as stereotypy in the literature, are one of the core features of autism spectrum disorder (ASD). Such stereotyped behavior is often considered to manifest in two distinct forms: lower order stereotypy and higher order stereotypy. Lower order stereotyped behaviors are those that include repetitive motor movement (e.g., hand flapping, body rocking, etc.) and higher order stereotyped behaviors consist of internal cognitive behaviors and adherence to a strict set of mental rules (e.g., performance of rituals, insistence on sameness, repetitive use of language, etc.). Stereotyped behavior is not unique to ASD; however, there is evidence that it is more frequent and severe among individuals with ASD than among individuals diagnosed with intellectual or other developmental disabilities. Campbell and colleagues examined stereotyped movements among 224 children with ASD and found that all but one child (99.6%) were rated as having at least mild stereotyped motor behavior. Similarly, Mayes and Calhoun reported that 85% of the 777 children with autism in their study engaged in some form of vocal stereotypy. Stereotyped behaviors have a number of negative consequences for individuals with ASD that create an impetus for treatment. Such behaviors can be socially stigmatizing and impact negatively upon integration efforts and opportunities for learning in the community. Research has also demonstrated that engagement in stereotypy is associated with impaired learning amongst persons with autism and reduced engagement in adaptive and social skills. Further, engagement in restricted and repetitive behaviors by persons with ASD has been found to be associated with caregiver stress. Although a great number of interventions for stereotypy have been trialed in the research literature with varying degrees of success (for a review, see Vollmer and colleagues have described the consideration, or development, of treatments for stereotypy as an exercise in social validity. The authors describe how the problems posed by engagement in the behavior (e.g., social stigmatization, impaired learning) must be juxtaposed against the intrusiveness of, and resources required by, an intervention designed to reduce the behavior. In this way, many of the treatments that have been shown to constitute evidence-based practice for the treatment of stereotypy (e.g., punishment procedures, extinction procedures) may not be considered appropriate for implementation in certain settings given their resource-intensive nature.

One intervention that has previously been identified as a promising treatment for stereotypy amongst persons with autism is inhibitory stimulus control procedures (ISCPs). ISCPs are antecedent-based interventions that aim to bring about the absence of a target behavior (e.g., social stigmatization, impaired learning) by reinforcing the absence of a specific external stimulus or multiple stimuli. The implementation of ISCPs typically requires a period of discrimination training. Discrimination training involves reinforcing the target behavior in the presence of a specific external stimulus and withholding reinforcement for the target behavior in the presence of an alternate environmental stimulus. Effective discrimination training results in the individual engaging in the target behavior only in the presence of the stimulus which is predictive of reinforcement for that behavior, and not engaging in or inhibiting the target behavior in the absence of that stimulus, or in the presence of other stimuli which indicate that the behavior will be punished or placed under extinction (i.e., not reinforced).
In this way, an individual can learn to discriminate conditions for when it is “acceptable” or “not acceptable” to engage in a specific behavior based upon the presence or absence of specific environmental stimuli (i.e., the behavior comes under stimulus control as a result of discrimination training). A stimulus that indicates that engagement in a target behavior will produce reinforcement is referred to as the discriminative stimulus (\(S^D\)), and a stimulus that indicates that engagement in the behavior will be punished is referred to as a discriminative stimulus for punishment (\(S^{DP}\)).\(^{15}\) Alternatively, a stimulus may indicate that engagement in the target behavior will not produce reinforcement or punishment and such stimuli are referred to as a stimulus delta (\(S^\Delta\)).\(^{15}\)

Stimulus control procedures comprise one of the key elements of behavior analytic instruction.\(^{16}\) However, their utility as a means of reducing engagement in stereotypy has received less attention.\(^{17}\) Although ISCPs often incorporate reinforcement or punishment techniques in order to establish stimulus control, the ultimate aim of ISCPs is to fade out, or discontinue, the use of these behavioral strategies and to bring responding under the control of a specific stimulus alone.\(^{18}\) When this is accomplished, ISCPs offer a less resource-intensive and less restrictive alternative to consequence-based interventions for challenging behavior, which is desirable\(^{19}\) and more socially valid.\(^{20,21}\) There is also the possibility that ISCPs may be applied to bring behavior under the control of naturally occurring stimuli, such as the presence of people (e.g., “when my teacher is present, I shouldn’t engage in this behavior”), locations (e.g., “I can engage in this behavior in the playground only”), and activities (e.g., “it’s ok to do this when I am listening to music”) which would greatly increase the practical applicability of these procedures. This is important given the increasing frequency with which persons with ASD are being taught in general education settings and the need for interventional techniques that are minimally resource-intensive and easily applied.\(^{22}\) Therefore, as ISCPs may comprise a more socially valid alternative to traditional, consequence-based behavioral interventions, it is important to synthesize what is known about their application and efficacy, and to make recommendations for programs of future research that will best further knowledge of ISCPs, and practitioners’ abilities to implement these interventions successfully in applied settings.

The current paper sought to critically review and synthesize the extant literature evaluating ISCPs as a means of treating stereotypy amongst persons diagnosed with autism. Treatment outcomes were analyzed quantitatively and the methodological rigor of the included studies was assessed as part of a comprehensive evaluation of the status of ISCPs as evidence-based practice for treating stereotypy amongst persons with autism.

**Method**

**Literature search**

Systematic searches were carried out in March 2016 and updated in September 2016, using the following electronic databases: Scopus, Psychology and Behavioral Sciences Collection, PsycINFO, Education Resources Information Center, and PubMed. In each database, searches were conducted by inputting a keyword related to diagnosis (i.e., autis*, developmental disabil*, intellectual disabil*) in combination with a keyword related to ISCPs (i.e., stimulus control, discrimination training, response inhibition, multiple schedule) and in combination with a keyword relating to behavior (i.e., behav*, stereotyp*) in order to form a three-component search term (e.g., autis* AND stimulus control AND behav*).

All abstracts returned during the electronic searches were reviewed to determine their suitability for inclusion. The reference lists of all included articles were also reviewed in order to identify additional studies suitable for inclusion.

**Inclusion criteria**

To be included in this review, studies were required to have: (1) included at least one individual diagnosed with an ASD, (2) applied an ISCP (defined as an “antecedent intervention that uses discrimination training in order to condition a response to occur in the presence of a particular stimulus … and not to occur in the absence of that stimulus or the presence of a different stimulus”[p. 220])\(^{23}\), alone or in combination with other intervention strategies, (3) target a form of stereotyped behavior (defined as repetitive motor or vocal behavior that persists in the absence of social consequences)-\(^{24,25}\) for reduction, (4) utilized a single-subject experimental design, and (5) been published in an English-language, peer-reviewed journal. Studies evaluating the efficacy of ISCPs for reducing challenging behaviors other than stereotypy, or with persons with diagnoses other than autism, were not eligible for inclusion in the current review.

**Data extraction**

Studies which met the inclusion criteria were analyzed independently by two PhD level psychologists with expertise in applied behavior analysis. For each study, data were independently extracted on the following variables: (a) participant characteristics (i.e., number of participants, age, diagnosis); (b) target behavior characteristics (i.e., topography, behavioral function); (c) intervention characteristics (i.e., pre-intervention assessments, setting, intervention agent, treatment integrity, experimental design, consequence for engaging in stereotypy, inhibitory stimulus employed, maximum length of response inhibition, test for stimulus control); (d) intervention outcomes (i.e., Treatment Effect Rating categorization, effect size), maintenance assessment and outcomes, generalization assessment and outcomes; and (e) research rigor (described in further detail below). Studies were assessed for the measurement of maintenance using Lydon, Healy, Moran, and Foody’s\(^{26}\) definition of maintenance: “the continuation of treatment effects following the removal of the [specific] treatment” (p. 474). In this review, studies were only coded as assessing maintenance when they presented data on the effects of the conditioned inhibitory stimulus alone, without presentation of the consequence if the participant engaged in or inhibited stereotypy, following the cessation of programed intervention. Studies were assessed for data on the measurement of generalization using Lydon et al.’s\(^{26}\) (p. 474)
definition: “generalization was defined as a concurrent or subsequent behavior reduction observed in situations in which the treatment had not been implemented.” All included studies were also assessed for the examination of, or testing for, stimulus control. In this review, studies were only coded as testing for stimulus control if they assessed the effects of the presence of the inhibitory stimulus in the absence of any other programed consequences for the target behavior. Thus, the conditions during the test for stimulus control were required to differ markedly from those during the standard intervention or discrimination training sessions during which the inhibitory stimulus was presented and engagement in the target behavior resulted in some consequence (e.g., response blocking, verbal reprimand). This element of research design was assessed using the standard outlined by Doughty and colleagues. The authors remarked that in order to ascertain unambiguous stimulus control of behavior, the behavior must be measured in the presence of the inhibitory stimulus when there is no consequence for engagement in behavior. This process allowed for the assessment of whether behavioral reduction or response inhibition was attributable to the presence of the inhibitory stimulus or was due to the consequences associated with engagement in the behavior during the intervention phase.

**Treatment efficacy**

Treatment efficacy was quantified in each included study by calculating an effect size using the Percentage of Zero Data (PZD) methodology. PZD was calculated by identifying the first data point to reach zero levels during the intervention phase(s) and determining the percentage of the treatment phase(s) data points, including the first data point to reach zero levels that was identified, which are at zero. PZD scores of <18% indicate “ineffective” treatment, scores of 18–45% suggest “questionable effectiveness,” scores of 55–80% suggest “fair effectiveness,” and scores of >80% indicate “high effectiveness.” PZD is considered a stringent measure of effect size that assesses the efficacy with which the target behavior is suppressed (i.e., at zero levels) during an intervention. Although complete behavioral suppression is not the goal of all behavioral interventions, it is desirable in the cases of severe and/or physically harmful challenging behaviors. In the current study, PZD was selected in lieu of alternate effect size measures that may have also been appropriate, based on Doughty and colleagues’ suggestion that stimulus control over behavior can be inferred from complete behavioral suppression in the presence of the discriminative stimulus (S').

**Evidence-based practice**

The empirical support for ISCPs was assessed using the National Autism Center’s (NAC) National Standards Report guidelines. These criteria have been applied in previous review papers to assess the evidence-base for interventions that have been applied for persons with ASD. The application of these criteria includes three distinct steps: (1) the experimental rigor of each research study is assessed using the Scientific Merit Rating Scale (SMRS); (2) the treatment outcomes within each study are interpreted using the Treatment Effects Rating criteria; and (3) SMRS scores and Treatment Effects Ratings emerging from the studies are collated in order to determine the strength of research evidence supporting the intervention under review, in this case ISCPs.

**SMRS**

Experimental rigor is evaluated using the SMRS by assessing each study’s: (1) research design, (2) measurement of the dependent variable, (3) measurement of the independent variable, (4) participant ascertainment, and (5) measurement of generalization. Each of these variables is assigned a score ranging from 5 (rigorous) to 0 (unsatisfactory) within each study, with clear definitions provided for the criteria required to achieve each score. For each study, the resulting scores are then collated to produce a composite score utilizing the following formula:

\[
\text{Research design (.30)} + \text{dependent variable (.25)} + \text{participant ascertainment (.20)} + \text{procedural integrity (.15)} + \text{generalization (.10)} = \text{SMRS score (rounded to nearest whole number)}
\]

SMRS scores of 3, 4, or 5 denote that a study is methodologically rigorous. An SMRS score of 2 indicates that the results of a study must be viewed as preliminary and that further research is required to validate the study’s findings. SMRS scores of 1 or 0 indicate that a study lacks methodological rigor and that the results cannot be interpreted as a consequence.

**Treatment Effects Ratings**

The NAC’s Treatment Effect Ratings criteria allow for the classification of treatment outcomes in each study as either: (a) beneficial which denotes that a study provided sufficient evidence that a treatment resulted in positive outcomes, (b) ineffective which denotes that a study provided sufficient evidence that a treatment did not result in positive outcomes, (c) adverse which denotes that a study provided sufficient evidence that a treatment resulted in negative or harmful outcomes, and (d) unknown which denotes that the study did not provide sufficient information to determine the outcomes of the treatment. For the majority of single-subject research designs (SSRDs), treatment effects are determined through the assessment of whether or not a functional relationship was demonstrated. However, in the case of one type of SSRD, the alternating treatments design, treatment effects are gauged based upon the separation between the data series, presence or absence of carryover effects, and the number of data points presented.

**Strength of evidence classification system**

Data arising from the application of the SMRS and Treatment Effect Ratings criteria are subsequently collated in order to establish the degree of empirical support for ISCPs as a treatment for stereotypy exhibited by persons with ASD. The categorization of a body of evidence requires the consideration of the number of group or SSRDs available, the SMRS scores received by these, the number of participants treated in these studies, the Treatment Effect Ratings, and the presence
of any conflicting results. As per the NAC guidelines,\textsuperscript{33} it is possible for the strength of evidence to be categorized as: (1) \textit{established} which indicates that there is sufficient evidence available to confidently assert that a treatment results in positive outcomes when applied among persons with ASD; (2) \textit{emerging} which indicates that although initial studies suggest that a treatment results in positive outcomes when applied among persons with ASD, further methodologically rigorous research studies are required to validate these findings; (3) \textit{ineffective/harmful} which indicates that there is sufficient evidence available to assert that a treatment results in negative or adverse outcomes when applied among persons with ASD; and (4) \textit{unestablished} which indicates that there is insufficient evidence to make assertions about the impact of the treatment when applied among persons with ASD.

\textbf{Inter-rater agreement}

The accuracy of data extraction, PZD calculation, SMRS ratings, and Treatment Effect Ratings was assessed by comparing the independent records produced by the two raters in order to establish the level of inter-rater agreement. In each case, percentage of inter-rater agreement was calculated by dividing the number of agreements recorded by the total number of opportunities for agreement and multiplying this figure by 100. Inter-rater agreement was found to be 96.4\% (range 87.5–100\%) for data extraction, 93.3\% for PZD calculation, 93.3\% (range 80–100\%) for SMRS ratings, and 83\% for Treatment Effect Ratings. Disagreements were resolved by discussion between the raters until consensus was achieved.

\textbf{Results}

In total, 11 studies published between 1983 and 2015 were identified as implementing an ISCP for the treatment of stereotyped behavior amongst persons with autism. Table 1 provides a summary of the sample characteristics, target behaviors, assessment procedures and outcomes, experimental design, intervention characteristics, treatment outcomes, and methodological rigor of each of these included studies.

\textbf{Participant characteristics}

A total of 18 participants (15 males, 3 females) received treatment in the included studies. The mean age of participants was 10.4 years (range 4–19 years). All participants were diagnosed with autism and some participants were described as having a co-occurring severe intellectual disability ($n = 2$)\textsuperscript{37} and one participant was described as high-functioning.$^{22}$

\textbf{Target behaviors}

As can be seen in Table 1, three studies included both motor and vocal stereotypy as target behaviors for reduction.$^{17,20,38}$ Across the 11 included studies, stereotyped motor behaviors were most frequently targeted for reduction using ISCPs ($n = 8$; 72.7\%).$^{17,18,20,22,36–38,41}$ The topographies of these stereotyped motor behaviors included hand flapping, finger manipulation, arm waving, body rocking, holding objects near eyes, string twirling, flipping the pages of books or magazines, and hand-to-neck pressing. Six of the studies targeted vocal stereotypy (54.5\%)$^{17,20,21,38,39,40}$ with topographies including non-contextual vocal words or sounds, nonfunctional speech, repetitive sounds, humming, scripting, and vocal bursts. Only one study$^{37}$ examined the efficacy of ISCPs for higher order stereotyped behavior, which took the form of excessive cleaning and/or ordering.

\textbf{Assessments}

Four studies (36.4\%)$^{20,21,36,37}$ reported conducting a pretreatment functional analysis alone in order to ascertain the function of participants’ stereotypy. Four studies (36.4\%)$^{17,18,39,40}$ included a pretreatment functional behavioral assessment alone, which included the use of indirect assessment tools, periods of direct observation, collection of informant reports, and/or file review. One study$^{22}$ reported that both a functional analysis and a functional behavioral assessment were carried out pretreatment. Two studies (18.2\%)$^{38,41}$ did not report carrying out a functional assessment or functional analysis prior to treatment implementation.

\textbf{Behavioral function}

The function of the target stereotyped behavior was found to be automatic reinforcement in all of the studies that assessed behavioral function.$^{17,18,20–22,36,37,39,40}$

\textbf{Experimental design}

Studies were required to utilize a SSRD in order to meet our inclusion criteria. The experimental design(s) used by each individual study are described in Table 1. Among the included studies, two studies (18.2\%)$^{22,37}$ utilized an alternating treatments (multielement) experimental design alone. Three studies (27.3\%)$^{20,36,39}$ employed a combination of a reversal design and alternating treatments design. One study$^{18}$ used a reversal design. The remaining studies used a variety of combined experimental designs, such as an alternating treatments design with an embedded three-component multiple schedule,$^{38}$ an ABC design with an embedded changing criterion design,$^{17}$ a changing conditions design with an embedded changing criterion design,$^{40}$ an ABCBC multiple baseline across settings design,$^{41}$ and a nonconcurrent multiple baseline across participants with an alternating treatments and a reversal design.$^{21}$

\textbf{Target behaviors}

As can be seen in Table 1, three studies included both motor and vocal stereotypy as target behaviors for reduction.$^{17,20,38}$ Across the 11 included studies, stereotyped motor behaviors were most frequently targeted for reduction using ISCPs ($n = 8$; 72.7\%).$^{17,18,20,22,36–38,41}$ The topographies of these stereotyped motor behaviors included hand flapping, finger manipulation, arm waving, body rocking, holding objects near eyes, string twirling, flipping the pages of books or magazines, and hand-to-neck pressing. Six of the studies targeted vocal stereotypy (54.5\%)$^{17,20,21,38,39,40}$ with topographies including non-contextual vocal words or sounds, nonfunctional speech, repetitive sounds, humming, scripting, and vocal bursts. Only one study$^{37}$ examined the efficacy of ISCPs for higher order stereotyped behavior, which took the form of excessive cleaning and/or ordering.

\textbf{Assessments}

Four studies (36.4\%)$^{20,21,36,37}$ reported conducting a pretreatment functional analysis alone in order to ascertain the function of participants’ stereotypy. Four studies (36.4\%)$^{17,18,39,40}$ included a pretreatment functional behavioral assessment alone, which included the use of indirect assessment tools, periods of direct observation, collection of informant reports, and/or file review. One study$^{22}$ reported that both a functional analysis and a functional behavioral assessment were carried out pretreatment. Two studies (18.2\%)$^{38,41}$ did not report carrying out a functional assessment or functional analysis prior to treatment implementation.

\textbf{Behavioral function}

The function of the target stereotyped behavior was found to be automatic reinforcement in all of the studies that assessed behavioral function.$^{17,18,20–22,36,37,39,40}$

\textbf{Experimental design}

Studies were required to utilize a SSRD in order to meet our inclusion criteria. The experimental design(s) used by each individual study are described in Table 1. Among the included studies, two studies (18.2\%)$^{22,37}$ utilized an alternating treatments (multielement) experimental design alone. Three studies (27.3\%)$^{20,36,39}$ employed a combination of a reversal design and alternating treatments design. One study$^{18}$ used a reversal design. The remaining studies used a variety of combined experimental designs, such as an alternating treatments design with an embedded three-component multiple schedule,$^{38}$ an ABC design with an embedded changing criterion design,$^{17}$ a changing conditions design with an embedded changing criterion design,$^{40}$ an ABCBC multiple baseline across settings design,$^{41}$ and a nonconcurrent multiple baseline across participants with an alternating treatments and a reversal design.$^{21}$
### Table 1. Studies employing inhibitory stimulus control procedures as a treatment for stereotyped behavior among individuals with autism.

<table>
<thead>
<tr>
<th>Study</th>
<th>Age range (mean; years)</th>
<th>Participant diagnosis</th>
<th>Target behavior(s)</th>
<th>Functional analysis/Assessment</th>
<th>Behavioral function</th>
<th>Experimental design</th>
<th>Maximum session length for response inhibition</th>
<th>Interventions utilized with inhibitory stimulus (reinforcer used, if any)</th>
<th>Inhibitory stimulus employed</th>
<th>PZD (%)</th>
<th>SMRS score</th>
<th>Treatment effects rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brusa and Richman [36]</td>
<td>1 8</td>
<td>Autism</td>
<td>Motor stereotypy</td>
<td>Functional analysis</td>
<td>Automatic reinforcement</td>
<td>Reversal design with embedded alternating treatments design</td>
<td>10 s</td>
<td>Vocal redirection response blocking, and DRO (access to stereotypy)</td>
<td>Colored card</td>
<td>72.7</td>
<td>1</td>
<td>Beneficial</td>
</tr>
<tr>
<td>Chok and Koessler [37]</td>
<td>2 14-18 (16)</td>
<td>Autism and severe intellectual disability</td>
<td>Higher order stereotyped behavior; motor stereotypy</td>
<td>Functional analysis</td>
<td>Automatic reinforcement</td>
<td>Alternating treatments design</td>
<td>2 min</td>
<td>Response blocking; Response blocking or interruption</td>
<td>Colored card</td>
<td>P1 = 0</td>
<td>P2 = 70.8</td>
<td>2</td>
</tr>
<tr>
<td>Conroy, Asmus, Sellers, and Ladwig [22]</td>
<td>1 6</td>
<td>High-functioning autism</td>
<td>Motor stereotypy</td>
<td>Functional behavior assessment and functional analysis</td>
<td>Automatic reinforcement</td>
<td>Alternating treatments design</td>
<td>10 min</td>
<td>Interventionist pointed to visual cue card and provided verbal reminder that it was not acceptable to engage in stereotypy at that time</td>
<td>Visual cue card</td>
<td>50</td>
<td>2</td>
<td>Beneficial</td>
</tr>
<tr>
<td>Cook, Rapp, Gomes, Frazer, and Lindblad [20]</td>
<td>5 5-18 (10.4)</td>
<td>Autism spectrum disorder</td>
<td>Vocal stereotypy; motor stereotypy</td>
<td>Brief functional analysis</td>
<td>Automatic reinforcement</td>
<td>Combined reversal and alternating treatments design</td>
<td>5 min for all; duration increased to 10 min for two participants</td>
<td>Contingent verbal reprimands</td>
<td>Colored poster board</td>
<td>P1 = 52.63</td>
<td>P2 = 11.62</td>
<td>P3 = 0</td>
</tr>
<tr>
<td>Frewing, Tanner, Bonner, Baxter, and Pastrana [38]</td>
<td>1 19</td>
<td>Autism spectrum disorder</td>
<td>Motor stereotypy; vocal stereotypy</td>
<td>–</td>
<td>–</td>
<td>Alternating treatments design with an embedded three-component multiple schedule</td>
<td>20 min</td>
<td>Response interruption and redirection</td>
<td>Wristband</td>
<td>1</td>
<td>1</td>
<td>Beneficial</td>
</tr>
<tr>
<td>Halsey, Heck, and Lusselli [39]</td>
<td>1 8</td>
<td>Autism</td>
<td>Vocal stereotypy</td>
<td>Functional behavior assessment and functional analysis</td>
<td>Automatic reinforcement</td>
<td>Alternating treatments design with embedded reversal design</td>
<td>15 min</td>
<td>Representation of inhibitory stimulus close to participant’s face</td>
<td>Colored card with text</td>
<td>0</td>
<td>2</td>
<td>Beneficial</td>
</tr>
<tr>
<td>Langone, Lusselli, and Hamill [18]</td>
<td>1 16</td>
<td>Autism</td>
<td>Motor stereotypy</td>
<td>Functional behavior assessment</td>
<td>Automatic reinforcement</td>
<td>A - B + C - A - B + C - A - C - B + C - C - A - C reversal type design</td>
<td>10 min</td>
<td>Response blocking</td>
<td>Wristband</td>
<td>0</td>
<td>1</td>
<td>Beneficial</td>
</tr>
<tr>
<td>LaPrime and Dittrich [40]</td>
<td>1 4</td>
<td>Autism spectrum disorder</td>
<td>Vocal stereotypy</td>
<td>Functional behavior assessment</td>
<td>Automatic reinforcement</td>
<td>Changing conditions design with an embedded changing criteria design</td>
<td>10 min total duration (comprised of five 2 min intervals)</td>
<td>Social story, token economy, DRL (access to stereotypy and preferred tangibles), response cost, and gestural prompt</td>
<td>Colored wristband or watch; Colored circle on activity schedule</td>
<td>Colored stimuli (poster boards and cards)</td>
<td>–</td>
<td>Data not suitable for PZD calculation</td>
</tr>
<tr>
<td>O’Connor, Prieto, Hoffman, DeQuinzio, and Taylor [17]</td>
<td>1 11</td>
<td>Autism</td>
<td>Motor stereotypy; vocal stereotypy</td>
<td>Functional behavior assessment</td>
<td>Automatic reinforcement</td>
<td>ABC design with an embedded changing criterion design</td>
<td>4 min and 15 s</td>
<td>Response blocking, redirection, and differential reinforcement (edibles, social praise, and access to stereotypy)</td>
<td>Colored card (poster boards and cards)</td>
<td>–</td>
<td>Data not suitable for PZD calculation</td>
<td>–</td>
</tr>
<tr>
<td>Rapp, Patel, Ghezzi, O’Flaherty, and Tettington [21]</td>
<td>3 5-8 (7)</td>
<td>Autism spectrum disorder</td>
<td>Vocal stereotypy</td>
<td>Functional analysis</td>
<td>Automatic reinforcement</td>
<td>Nonconcurrent multiple baseline across participants with an alternating treatments and a reversal design (n = 2); combined alternating treatments design and ABCD/’B design (n = 1)</td>
<td>5 min</td>
<td>Contingent verbal reprimands (n = 3); contingent verbal reprimand- more aversive (n = 1); contingent verbal reprimand and response cost (n = 1)</td>
<td>Colored card</td>
<td>P1 = 50</td>
<td>P2 = 20</td>
<td>P3 = 50</td>
</tr>
<tr>
<td>Woods [41]</td>
<td>1 10</td>
<td>Autism</td>
<td>Motor stereotypy</td>
<td>–</td>
<td>–</td>
<td>ABCBC multiple baseline across settings design</td>
<td>5 min</td>
<td>Physical restraint, verbal reprimand, and differential reinforcement (social praise for behavior in absence of inhibitory stimulus)</td>
<td>Colored triangle</td>
<td>Mean PZD across settings was 65.4</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

PZD: Percentage of zero data; SMRS: Scientific Merit Rating Scale; DRO: differential reinforcement of other behavior.
**Intervention agent**

Four studies (36.4%)\textsuperscript{18,36,39,40} reported that the ISCP was delivered solely by school staff. Four studies (36.4%)\textsuperscript{17,20,37,38} reported that the intervention was implemented by the experimenter or researchers. Of the remaining studies, one reported multiple intervention agents (i.e., researcher and school staff)\textsuperscript{12} and two studies (18.2%)\textsuperscript{1,21,41} did not provide details on the individual(s) who conducted the intervention.

**Treatment integrity**

Of the 11 included studies, only 2 (18.2%)\textsuperscript{17,39} reported that treatment integrity data were collected to assess the fidelity with which the intervention was delivered. In both of these studies, treatment integrity was found to be greater than 95%.

**Maximum session length for response inhibition**

The reviewed studies reported varying maximum session lengths for response inhibition, duration ranged from 10 s\textsuperscript{20} to 20 min.\textsuperscript{38} The mean terminal session duration for response inhibition for a participant in the reviewed studies was 6.1 min.

**Interventions utilized with ISCPs**

**Reinforcement**

None of the studies reviewed reported the use of a reinforcement contingency alone.

**Punishment**

Five studies (45.5%; see Table 1)\textsuperscript{18,20,21,37,38} employed punishment procedures alone with the ISCP. The punishment techniques utilized included response blocking,\textsuperscript{18,37} response interruption and redirection,\textsuperscript{37,38} verbal reprimands (20, 21), and response cost.\textsuperscript{21}

**Combined intervention**

As can be seen in Table 1, four studies (36.4%)\textsuperscript{17,36,40,41} employed a combination of reinforcement and punishment techniques. Brusa and Richman\textsuperscript{36} used a combination of punishment, in the form of redirection and response blocking, and reinforcement, in the form of a DRO. LaPrime and Dittrich\textsuperscript{40} used an antecedent intervention (i.e., a social story) in combination with reinforcement (i.e., DRL), a gestural prompt, and punishment in the form of response cost. O’Connor et al.\textsuperscript{17} used punishment (i.e., redirection and response blocking) and differential reinforcement. Finally, Woods\textsuperscript{41} used punishment procedures, in the form of physical restraint and verbal reprimands, in combination with differential reinforcement procedures.

**Other**

Two studies (18.2%)\textsuperscript{22,39} did not employ any additional interventions with the ISCP. Specifically, Conroy and colleagues\textsuperscript{22} required the interventionist to point to the inhibitory stimulus upon engagement in the target behavior and verbally reminded the participant that the target behavior was not acceptable when the inhibitory stimulus was present. Haley et al.\textsuperscript{39} required the interventionist to represent the inhibitory stimulus close to the participant’s face upon engagement in stereotypy under the relevant stimulus control condition.

**Inhibitory stimulus topography**

Three studies (27.3%)\textsuperscript{18,38,40} utilized a stimulus that was worn on the participants’ wrist (i.e., a wristband, a watch, a bracelet) in order to signal the conditions wherein it was acceptable or not acceptable to engage in stereotypy. LaPrime and Dittrich\textsuperscript{40} used two inhibitory stimuli in the form of a colored wristband or watch along with a colored circle placed on participants’ activity schedules in order to establish stimulus control over the occurrence of stereotypy. Eight studies (72.7%)\textsuperscript{17,20–22,36,37,39,41} reported using some form of card or poster board distinguishable via color, text, or some other visual cue, as the inhibitory stimulus within their intervention.

**Intervention outcomes**

**Intervention efficacy; PZD**

It was possible to compute PZD scores for participants in all but two\textsuperscript{17,40} of the included studies (81.8%). PZD scores ranged from 0% to 72.7% with the average PZD score for a participant in the included studies found to be 31.8%.

**Treatment Effect Ratings**

Intervention outcomes were also assessed using the NAC’s Treatment Effects Ratings guidelines.\textsuperscript{33} All of the included studies were determined to produce beneficial outcomes, which indicates that sufficient evidence was present (i.e., a functional relation was demonstrated) to suggest that the treatment produced positive outcomes (i.e., decreased stereotypy behavior) for the individuals who received it.

**Generalization**

Only two of the included studies (18.2%)\textsuperscript{17,21} were identified as measuring the generalization of treatment effects as per Lydon et al.’s\textsuperscript{26} definition of generalization. Both of these studies reported the assessment, and observation, of the generalization of treatment effects to a novel setting.

**Maintenance**

Two of the included studies (18.2%)\textsuperscript{18,40} reported data on the maintenance of treatment effects following the cessation of intervention. Langone et al.\textsuperscript{18} conducted maintenance probes 1, 2, and 3 weeks post-intervention and reported that treatment effects persisted. LaPrime and Dittrich\textsuperscript{40} provided an anecdotal report that treatment effects persisted during vacation periods.

**Stimulus control**

Four studies (36.4%)\textsuperscript{17,18,21,40} were identified as testing for stimulus control, although LaPrime and Dittrich\textsuperscript{40} did not present data on the outcomes of this assessment. Langone et al. described a condition in which the inhibitory stimulus was present (i.e., participant wore the wristbands) but the consequence (i.e., response blocking) was not implemented upon engagement in stereotypy. Stereotypy remained at low levels during this condition indicating that the wristbands had acquired stimulus control over the stereotyped behavior. O’Connor et al.\textsuperscript{17} reported on the outcomes of a generalization assessment during which the inhibitory stimulus was presented in a novel setting and no consequence was delivered.
for engagement in stereotypy. The participant did not emit any stereotypy during this probe. Rapp et al.\textsuperscript{21} conducted a stimulus control assessment for one participant. The inhibitory stimulus was present during a condition equivalent to baseline conditions (i.e., no other intervention in effect) and the target stereotyped behaviors were at zero levels during this probe.

**Methodological Rigor (SMRS scores)**

The methodological rigor of the included studies was evaluated using the NAC’s SMRS.\textsuperscript{33} Five of the included studies (45.5%) received an SMRS score of 1 (i.e., insufficient methodological rigor) and the remaining six studies (54.5%) received an SMRS score of 2 (i.e., limited methodological rigor but provides preliminary evidence of treatment effects).

**Classification of the strength of evidence**

The NAC’s guidelines\textsuperscript{33} on evaluating the strength of the evidence supporting the procedure under investigation were used in order to determine the empirical support for the use of ISCPs in the treatment of stereotyped behavior amongst persons with autism. This analysis suggested that the ISCPs could be classified as an emerging treatment for stereotypy as 6 studies with SMRS scores of 2 including 11 participants were identified. The categorization of an intervention as emerging indicates that initial research suggests that the treatment results in positive outcomes but that further methodologically rigorous studies are required in order to draw firm conclusions about the intervention’s effectiveness.

**Discussion**

ISCPs comprise an antecedent-based behavioral intervention that involves the use of discrimination training to teach an individual when it is, or is not, appropriate to engage in a specific behavior based upon the presence or absence of specific and salient conditioned external stimuli. Previously, behavior analytic scholars\textsuperscript{14} have described a quandary surrounding the social validity of intrusive or resource-intensive consequence-based behavioral interventions, such as punishment-based techniques, to treat stereotyped behaviors which typically do not have negative physical effects on the individual or others in their environment. However, the association between engagement in these stereotyped behaviors and caregiver stress,\textsuperscript{12} impaired learning,\textsuperscript{9} and reduced engagement in adaptive or social behavior\textsuperscript{10,11} does create an impetus for some form of intervention. ISCPs have been suggested as a more socially valid alternative to traditional, consequence-based behavioral interventions for stereotypy described in the literature.\textsuperscript{21} However, the use of ISCPs in the treatment of stereotyped behaviors among persons diagnosed with autism has received relatively limited research evaluation here-tofore, with only 11 studies identified for inclusion in the current review. Although the existing research evidence is sufficient to classify these interventional techniques as an emerging treatment for stereotyped behavior in ASD, the synthesis of this body of literature provides important direction for future research and for the use of this intervention in clinical practice.

The classification of ISCPs as an emerging treatment for stereotypy among those with autism indicates that although initial research has demonstrated positive effects for this intervention, further methodologically rigorous research is required before this intervention can be considered as established or evidence-based practice.\textsuperscript{33} Other scholars\textsuperscript{14,22} have also noted a growing body of support for the use of ISCPs, in the context of reviews of broader bodies of literature. Although this review was focused upon the assimilation of research employing single subject experimental designs to assess ISCPs, it is important to note that no group designs assessing the efficacy of these procedures were identified during searches. Future research that evaluates ISCPs in the context of group designs would contribute substantially to the assessment of whether ISCPs constitute evidence-based practice. The findings of this review regarding the growing body of literature to support the use of ISCPs may nonetheless be considered positive given the perceived advantages of ISCPs over traditional consequence-based behavioral interventions that have been employed to reduce or eliminate stereotypy.\textsuperscript{18,20,21} ISCPs are described as an antecedent-based intervention and thus should constitute a less resource-intensive or intrusive intervention for stereotypy than traditional consequence-based interventions, such as response blocking, that are often used to treat these behaviors (for a review of treatments used to treat stereotypy, see [13]). Antecedent-based interventions are often considered more practicable or feasible within typical educational settings.\textsuperscript{21,22} However, only four studies in the current review examined the effects of the ISCP in the absence of programmed consequences for engagement in the target behavior (i.e., as a true antecedent-based intervention). Future research evaluating the effects of ISCPs following the discontinuation of programmed consequences used during the discrimination training period is required in order to substantiate these claims of treatment efficacy in the absence of such programmed consequences.

The application of the NAC’s guidelines\textsuperscript{33} for discerning treatment effects revealed that all included studies produced beneficial treatment effects. However, the quantitative analysis of treatment effects via PZD statistics\textsuperscript{29} provided a more nuanced picture of treatment outcomes among the included studies. PZD scores among the included studies ranged from 0% (ineffective)\textsuperscript{36} to 72.7% (fair effectiveness)\textsuperscript{30} and none of the studies demonstrated complete suppression or elimination of stereotypy in the presence of the inhibitory stimulus. Although this finding is perhaps not concerning from a treatment effectiveness viewpoint, it may call into question whether stimulus control was established in the included studies. In their discussion of discriminative control over behavior, Doughy and colleagues\textsuperscript{27} (p. 326) have noted “unless responding is suppressed completely ... reduced response rate alone does not provide conclusive evidence that the $S^D$ or $S^D$] is functionally the discriminative stimulus for response suppression.” Doughy et al.\textsuperscript{27} suggest that it is possible that, in the absence of complete response inhibition in the presence of the inhibitory stimulus alone, changes in behavior may be attributable to the delivery of the contingent
consequence rather than the presence of the inhibitory stimulus. In order to better understand the treatment effects observed in the reviewed papers, we coded studies as testing for stimulus control/not testing for stimulus control based on whether they included a phase during which the inhibitory stimulus was present but during which engagement in the target behavior did not produce the consequences that had been employed during the discrimination training phase (e.g., response blocking, verbal reprimands, etc.) nor any positive reinforcement component for response inhibition. However, as the majority of studies in this review \( (n = 7; 63.6\%) \) did not test for stimulus control, it is difficult to disentangle what component of the intervention is responsible for reductions in stereotypy observed and to discern whether stimulus control was established. This failure to conclusively demonstrate stimulus control in research studies has been previously noted by Doughty and colleagues\(^{28} \) and is problematic. One purported advantage of ISCPs is that, by bringing responding under the control of a salient external stimulus through discrimination training, they can allow for the fading or discontinuation of resource-intensive, intrusive consequence-based behavioral techniques such as response blocking, physical restraints, or verbal reprimands.\(^{18} \) However, this theory was not adequately explored in the studies reviewed. Therefore, the failure to explicitly test for stimulus control and to present data on such outcomes does little to inform our understanding of any difficulties surrounding the fading of the associated consequences or the maintenance of treatment effects in the absence of programmed consequences for responding in the presence of the inhibitory stimulus. Future research studies must employ more nuanced methodologies that allow for the direct comparison of the effects of the inhibitory stimulus in combination with the programmed consequences (i.e., discrimination training phase), the effects of the inhibitory stimulus alone (i.e., test for stimulus control), and the effects of the paired consequence alone (i.e., response blocking, verbal reprimands, or other consequences presented contingent on behavior but in the absence of the inhibitory stimulus). Such data are essential for ascertaining if effective stimulus control has been established resulting in response inhibition in the presence or absence of that stimulus. An analysis of such outcomes should: (1) improve knowledge surrounding the potential to bring problem behavior under stimulus control, (2) better inform the clinical utility of ISCPs in practice, and (3) substantiate claims that ISCPs allow for the fading out of intrusive contingent consequences.

The application of the NAC’s guidelines\(^{33} \) for evaluating the empirical support for a treatment includes the evaluation of the methodological quality of the studies under review using the SMRS. The lack of methodologically rigorous studies evaluating ISCPs precluded the intervention from being classified as evidence-based practice in the current review. Although SMRS scores may range from 0 to 5, almost half of the included studies received an SMRS score of 1, indicative of insufficient methodological rigor to contribute empirical support for an intervention, and the remainder of studies received an SMRS score of 2 which is indicative of limited methodological rigor. The studies reviewed had a variety of weaknesses such as small participant numbers, collection of insufficient number of data points within conditions, infrequent measurement of treatment fidelity or integrity, limited participant descriptions, and the non-measurement of the maintenance or generalization of treatment effects. Other reviews of interventions based on the science of applied behavior analysis\(^{32,34,43} \) have noted similar weaknesses within some bodies of behavioral research. The span of behavioral research likely contributes to this, given that accepted methodological practices change across time, and older studies viewed through the lens of recently developed methodological assessment tools may perform less well. Readers and researchers should keep this in mind when applying, or interpreting the outcomes from, methodological assessment tools applied to bodies of literature that include older studies. Going forward, it is important that behavioral researchers endeavor to stay abreast of, and observe, current best practice surrounding experimental design, measurement of dependent and independent variables, participant description, and assessment of generalization and maintenance of treatment effects when designing and publishing scientific evaluations of behavioral interventions. Given that less than half of the included studies incorporated functional analysis techniques, in spite of these being considered best practice in behavioral research pertaining to the assessment and treatment of challenging behavior,\(^{44} \) there is a need also for future research on ISCPs to employ functional analysis when assessing the function of the targeted behavior. Such methodologically rigorous research will allow for the most accurate ascertainment of what interventions truly constitute evidence-based practice amongst persons with developmental disabilities including autism and will ensure that all individuals receive effective interventions.

There are a number of limitations to the current review that must be noted. First, as with all research syntheses and meta-analyses, it is possible that the outcomes of this paper were affected by publication bias. Publication bias arises due to the tendency for journals to publish studies reporting favorable outcomes and to reject papers finding null outcomes or reporting treatment failures.\(^{45} \) It is important that readers interpret the outcomes of the current review with this in mind. Previous research has noted the stringency of the NAC guidelines\(^{33} \) but has lauded their “explicit and unambiguous criteria”(p. 15)\(^{34} \). It is possible that the use of alternative criteria\(^{46–48} \) for the evaluation of the empirical status of the ISCPs may have yielded different outcomes regarding the empirical support of inhibitory stimulus control interventions. Similarly, PZD has been noted to be a strict or highly conservative measure of treatment effects.\(^{32} \) PZD reflects the degree to which behavior is suppressed rather than reflecting reductions in behavior. In many cases, particularly in the treatment of stereotypy,\(^{49} \) the complete elimination of the target behavior is not sought and clinically significant reductions in the behavior may be considered a successful treatment outcome. However, we employed PZD to quantify treatment outcomes in this review as Doughty et al.\(^{27,28} \) have noted the suppression of behavior in the presence of the inhibitory stimulus to be one means of ascertaining that responding has come under the control of the inhibitory stimulus and the demonstration or non-demonstration of stimulus control was a point of interest in the current review.
Similarly, the Doughty et al.\textsuperscript{27,28} criteria for assessing the presence of stimulus control may be considered stringent or overly exacting as the authors consider stimulus control as an "all-or-nothing" phenomenon yet others may consider stimulus control to occur on a continuum. However, to our knowledge, no empirically based definition or guide for assessing stimulus control exists outside of Doughty and colleagues\textsuperscript{27,28} work. Other researchers may wish to conceptualize or assess the presence of stimulus control within this body of literature, or in future studies, in an alternative manner. The decision to limit the review solely to studies using ISCPs to treat the stereotypy of persons with ASD may also be critiqued. The inclusion of studies employing ISCPs in the treatment of other target behaviors\textsuperscript{30} or in other populations\textsuperscript{31} may have yielded a better understanding of the effects of ISCPs and contributed empirical support for their use amongst persons with developmental disabilities. However, it was considered to be more precise and useful to assess the procedure as a treatment for a specific target behavior within a specific population. Other researchers may wish to conduct reviews of the broader research based on ISCPs.

It is evident from the current synthesis of empirical literature in this area that there remain many interesting questions, in addition to those described earlier, that have heretofore not been sufficiently addressed in the extant literature and that future researchers should pursue. The following sections address these issues and provide recommendations for future research on ISCPs. First, the lack of research investigating the use of reinforcement procedures in combination with ISCPs is of note. None of the studies reviewed assessed a reinforcement procedure alone with the inhibitory stimulus, and only four studies (36.4\% \textsuperscript{17,36,40,41}) utilized a reinforcement procedure within a treatment package associated with the inhibitory stimulus. The remaining studies either did not incorporate any additional intervention with the inhibitory stimulus or included punishment procedures as part of the intervention package. Given the prevailing focus on selecting positive only approaches in both research and practice, there is a clear need for future research to further evaluate the efficacy of ISCPs reliant on reinforcement procedures alone, rather than those employing punishment-based techniques or mixed treatment packages. Studies focused on evaluating the use of access to stereotypy as a reinforcer within an ISCP intervention package, as in four of the included studies, would yield particularly useful data for researchers and practitioners keen to employ minimally restrictive behavioral interventions.

Second, there was a notable degree of variability in individual treatment outcomes (e.g., level of behavioral suppression) within and across the studies reviewed. Given the potential benefits of ISCPs over traditional consequence-based approaches to behavioral intervention, it is important that future research considers this individual variability and assesses characteristics of the intervention package, target behavior, or participants that may predict greater or lesser treatment efficacy.

Third, Cook and colleagues\textsuperscript{20} have noted the importance of assessing the effects of ISCPs on untargeted challenging behaviors and untargeted appropriate/alternative behavior. For example, the collateral effects of an ISCP for vocal stereotypy could be assessed by measuring untargeted behaviors such as alternative and appropriate verbal behavior or replacement motor stereotypy. Only a small number of the studies in the current review\textsuperscript{20,22,41} empirically assessed the effects of their intervention on untargeted behaviors including on-task engagement, other untargeted topographies of stereotypy, and non-responding with mixed outcomes observed. However, LaPrime and Dittrich\textsuperscript{40} described anecdotal reports of increased appropriate verbal behavior as targeted vocal stereotypy decreased. Additional data are therefore necessary in order to discern any positive or negative collateral effects that may result from the application of ISCPs.

Fourth, there was a dearth of information in the included studies concerning the maximum length of response inhibition programed or achieved. Maximum session length for response inhibition in the studies ranged from 10 s to 20 min ($M = 6.7$ min). Few studies explained or justified the time interval selected for response inhibition. Future studies should endeavor to clarify and establish the terminal duration of response inhibition and the social validity of this interval. It must also be noted that none of the included studies assessed participants’ attending to the specific inhibitory stimuli being used as $S^D$, $S^P$, or $S^A$. Attending to these stimuli during discrimination training is essential if the behavior is to come under their control. Researchers may wish to include measures of attention to stimuli during future evaluations of ISCPs. The data resulting from the assessment of attention in this manner may contribute to an understanding of individual variability in ISCP treatment outcomes.

Fifth, researchers may assess the participant, treatment, or other characteristics that predict the successful establishment of stimulus control. For example, within the included studies, Rapp et al.\textsuperscript{31} reported that responding of only one of three participants was brought under the control of the inhibitory stimulus in their study. Research-identifying factors predictive of successful treatment (i.e., establishment of stimulus control) would be of much interest to both researchers and practitioners. Another area of interest is the application of ISCPs to treat higher order stereotyped behavior. Only one study\textsuperscript{37} in the current review reported such an application of ISCPs and found that the treatment of these behaviors was less successful than the treatment of the motor stereotypy displayed by the other participant in the study. Future research extending the study of the efficacy of ISCPs to such higher order behavior may help us understand the external validity of Chok et al.’s\textsuperscript{37} findings and the limits that the procedure may have.

It must be noted also that there was little focus on the time required to produce positive treatment outcomes in the included studies. Future research that defines treatment success clearly in the context of ISCPs and that examines typical intervention durations required for achieving this, or identifies predictors of quicker/slower treatment progression, would be of use for both clinicians and researchers.

Finally, we have described earlier in the paper the potential for, and desirability of, ISCPs that bring behavior under the control of naturally occurring stimuli (e.g., presence of specific individuals, specific locations or activities). To date, the current body of research has only examined ISCPs centered on artificial or contrived inhibitory stimuli.
Future research that incorporates naturally occurring stimuli in their stead would contribute invaluablely to knowledge development on ISCPs and greatly advance this area of research and practice.

Declaration of interest

The authors report no conflicts of interest.

References

15. Cooper JO, Heron TE, Heward WL. Applied behaviour analysis. 2nd ed. 2007.
38. Frewing TM, Tanner A, Bonner AC, Baxter S, Pastrana SJ. The immediate and subsequent effects of response interruption and