Online Supplement

**Modular Cognitive Behavioral Therapy for Autism-Related Symptoms in Children:**

**A Randomized, Controlled Trial**

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eTable 1

*Comparison of Clinical Foci, Methods, and Corresponding Evidence-Based Practices (EBPs) Utilized in CBT and ESCT*

|  |  |  |
| --- | --- | --- |
|  | CBT | ESCT |
| Main Characteristics of Treatment | 32 90-minute sessions, about half of each is spent with the child, and half spent with the parents/family. | 32 90-minute treatment groups for children and 32 concurrent 60-minute groups for parents. |
| Core Practices Used in Most Sessions | Self-management, perspective taking and reframing, and positive reinforcement (direct intervention and parent training, including weekly homework) tailored to each child. | Reframing and perspective taking taught in reference to session content (e.g., coping with anxiety; acting flexible with peers); modeling and positive reinforcement used in direct intervention with the child group; no individualized therapy homework assigned, but families are encouraged to use the skills in daily life. |
| Dysregulated and Disruptive Behavior | *How Many Sessions*? Individualized to each child (generally 2 to 6 sessions, based on clinical response or plateau). *What EBPs Are Used?* Core Practices (above) plusmodeling, antecedent management, and extinction tailored to each child. Incentive-based goal charts are a central tool for many families in this module that are also used as a compendium of current goals and behavioral exercises (for home- or school-based practice) throughout treatment. *Maintenance*? Efforts are made to maintain home-based practices (e.g., reward chart goals) and to trouble shoot new problems (including having a non-sequential session from this module) throughout the 32 sessions. | *How Many Sessions*? One session (#11). *What EBPs Are Used?* Core Practices (above) plusin vivo exposure applied to suppressing angry behavior when confronted with frustration. *Maintenance*? Children learn to adapt a coping plan for themselves to manage anger and frustration in daily life, and parents are taught this plan to help support the child’s implementation. |
| Anxiety and Depression | *How Many Sessions*? Individualized to each child (generally 0 to 10 sessions, based on clinical response or plateau). *What EBPs Are Used?* Core Practices (above) plusin vivo exposure and pleasant activity scheduling (including exercise) tailored to each child’s symptoms and preferred activities. For example, goals might include staying in a dark room alone for a certain amount of time while remaining calm to target separation anxiety. *Maintenance*? Efforts are made to maintain home-based practices (e.g., in vivo exposures) and to trouble shoot new problems (including having a non-sequential session from this module) to target slower-remitting anxiety and depression symptoms once this module is complete. | *How Many Sessions*? Nine sessions (#2-10). *What EBPs Are Used?* Core Practices (above) plusin vivo exposure applied to anxiety symptoms and negative self-talk. For example, children take turns engaging in exposure tasks in front of one another engaging in “silly” behavior to address social anxiety symptoms. *Maintenance*? Children learn to adapt a coping plan for themselves to manage anxiety and worry in daily life, and parents are taught this plan to help support the child’s implementation. |
| Rigid and Repetitive Behavior | *How Many Sessions*? Individualized to each child (generally 0 to 10 sessions, based on clinical response or plateau). *What EBPs Are Used?* Core Practices (above) plusexposure with response-prevention and habit reversal. For example, goals might include suppressing repetitive topics of conversation even when given tempting conversational cues, or intentionally breaking a routine or ritual for a certain amount of time without “fixing it”. *Maintenance*? If symptom remission is incomplete at the end of the module, goals and practices related to rigid and repetitive are kept on the incentive chart to maintain positive reinforcement for continued effort in this area. | *How Many Sessions*? Three sessions (#12, 14, 15). *What EBPs Are Used?* Core Practices (above) plusexposure with response-prevention applied to suppressing rigid and bossy behavior when confronted with changed rules, differences of opinion, and unexpected circumstances. These skills are practiced in a group setting, for example, by playing games like tag in which rules are changed in increasingly challenging ways while children maintain the goal of remaining calm and flexible. *Maintenance*? Children learn to adapt a coping plan for themselves to promote flexibility in daily life, and parents are taught this plan to help support the child’s implementation. |
| Peer Engagement in School and the Community | *How Many Sessions*? Individualized to each child (generally 3 to 8 sessions, based on clinical response or plateau). *What EBPs Are Used?* Core Practices (above) plus modeling and systematic desensitization (focusing on school, playground, and community social contexts). For example, goals might include joining peers at lunchtime or joining in games like tag at a public park for increasing amounts of time. In some cases, some session time needs to be devoted to teaching critical game-playing skills that will be needed (e.g., the rules of capture the flag; how to play handball). *Maintenance*? Depending on clinical response, once they are introduced, individualized goals and practices related to peer engagement are kept on the incentive chart through the end of treatment and beyond. | *How Many Sessions*? Three sessions (#13, 27, 28). *What EBPs Are Used?* Core Practices (above), emphasizing modeling and perspective taking, plussystematic desensitization (focusing on school, playground, and community social contexts). These skills are practiced in a group setting, for example, by playing playground games in a courtyard or deck and having children practice joining and engaging in the group game, adapting methods developed for friendship skills training (Frankel & Myatt, 2002). *Maintenance*? Children are encouraged to use these skills in daily life, and parents are taught these skills to facilitate the child’s implementation. |
| Conversation and Friendship | *How Many Sessions*? Individualized to each child (generally 3 to 10 sessions, based on clinical response or plateau). *What EBPs Are Used?* Core Practices (above) plus pivotal response treatment and friendship skills training. For example, goals might include practicing question-asking or comment-making that vary maintenance (child-oriented topics; simple pragmatic structures) and acquisition (partner-initiated topics; complex pragmatic structures such as to-and-fro) conversation tasks, intersperse naturalistic partners (parents, siblings), use contingent and natural reinforcement, and plan for generalization in naturalistic settings (incentive chart goals for practice at home and school). Friendship skills include practicing being a good host of playdates and actually hosting playdates with these skills (cf. Frankel & Myatt, 2002). *Maintenance*? In some cases, once they are introduced, individualized goals and practices related to conversations and friendship may be kept on the incentive chart through the end of treatment and beyond—for example, for a child who has not experienced sufficient social motivation to internalize these interactions as intrinsically rewarding. | *How Many Sessions*? Thirteen sessions (#16 to 26, 29, 30). *What EBPs Are Used?* Core Practices (above), emphasizing modeling and perspective taking, plusgroup-adapted pivotal response treatment and friendship skills training. For example, goals include practicing question-asking or comment-making that vary maintenance (child-oriented topics; simple pragmatic structures) and acquisition (partner-initiated topics; complex pragmatic structures such as to-and-fro) conversation tasks, intersperse naturalistic partners (group member peers), and use natural reinforcement. Friendship skills include practicing being a good host of playdates (cf. Frankel & Myatt, 2002). *Maintenance*? Children are encouraged to use these skills in daily life, and parents are taught these skills to facilitate the child’s implementation. |
| Self-Care Skills | *How Many Sessions*? Individualized to each child (generally 1 to 5 sessions, based on clinical response or plateau). *What EBPs Are Used?* Core Practices (above) plus task analysis. For example, goals might include selecting self-care tasks that a child can perform but currently receives assistance for at home, and making them an explicit goal for independent task completion (e.g., choosing clothes), or self-care tasks that require some teaching, in which the parent might do all but the last step for the child and work backwards until mastery has been achieved (e.g., making breakfast for oneself). *Maintenance*? Generally, once independence in the new self-care tasks has been achieved, there are only periodic check-ins about maintenance during the remainder of therapy as these skills tend to persist once new routines are established. | Self-care skills are not addressed in ESCT. |

eTable 2

*Estimated Marginal Means of Pre-Treatment (Session 1) and Post-Treatment (Session 32) Scores from HLM Models for Effects of CBT Versus ESCT on YTP Scores for Specific Symptom Domains*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sample Size | | Pre-treatment (Session 1)  Estimated Marginal Means (*SE*s) | | Post-treatment (Session 32)  Estimated Marginal Means (*SE*s) | | Treatment Group by Time Interaction Fixed Effect |
| Scale | CBT | ESCT | CBT | ESCT | CBT | ESCT | *B* (*SE*), *p-*value |
|  |  | |  |  |  |  |  |
| YTP Social-Communication | 40 | 47 | 12.58 (.84) | 12.00 (.77) | 6.80 (.84) | 8.82 (.77) | -.084 (.012), <.001 |
| YTP Restrictive-Repetitive | 23 | 25 | 8.44 (.71) | 8.10 (.67) | 3.95 (.72) | 6.04 (.69) | -.079 (.012), <.001 |
| YTP Externalizing | 26 | 21 | 9.72 (.85) | 7.83 (.77) | 5.88 (.86) | 6.34 (.78) | -.076 (.014), <.001 |
| YTP Internalizing | 6 | 6 | 7.01 (.74) | 7.99 (.76) | 2.32 (.75) | 5.35 (.81) | -.066 (.022), .003 |

*Note.* HLM=hierarchical linear model. YTP=Youth Top Problems scale. CBT=cognitive behavioral therapy. ESCT=enhanced standard community

treatment.

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Primary analysis (*n*POPE=40/54):

* Valid POPE data at both timepoints (*n*=26)
* Post-treatment POPE data imputed from the model variables (*n*=14)
* No valid pre-treatment POPE data, eliminating case from primary model (*n*=14)

Post-treatment/post-discontinuation testing:

* Children with valid POPE data (*n*POPE=31/54)
* Family and/or school did not facilitate follow up POPE observation (*n*=15/54)
* Child observed at school but was not present in an outdoor free play setting (*n*=8/54)

**Analysis**

Post-treatment/post-discontinuation testing:

* Children with valid POPE data (*n*POPE=35/53)
* Family and/or school did not facilitate follow up POPE observation (*n*POPE=7/53)
* Child observed at school but was not present in an outdoor free play setting (*n*POPE=10/53)

Primary analysis (*n*POPE=44/53):

* Valid POPE data at both timepoints (*n*=32)
* Post-treatment POPE data imputed from the model variables (*n*=12)
* No valid pre-treatment POPE data, eliminating case from primary model (*n*=9)

Completed baseline, randomized, and began treatment (*n*=107)

NIMH Sample: Assessed for eligibility (*N=*84)

Autism Speaks Sample: Assessed for eligibility (*N=*64)

Excluded (*n*=14):

* Not meeting inclusion criteria (*n*=13)
* Declined to participate (*n*=1)

Excluded (*n*=16):

* Not meeting inclusion criteria (*n*=14)
* Declined to participate (*n*=2)

Eligible for study (*n*=48)

* Failed to complete baseline (*n*=2)
* Failed to begin treatment (*n*=3)

Eligible for study (*n*=70)

* Failed to complete baseline (*n*=3)
* Failed to begin treatment (*n*=3)

**Allocation**

Allocated to **CBT** (*n*=54):

* Began allocated intervention (***n*=54**)

Allocated to **ESCT** (*n*=53):

* Began allocated intervention (***n*=52**)
* Dropped out before intervention (*n*=1)

**Treatment**

**Post / Follow-Up**

Discontinued treatment prematurely (*n*=10/54):

* For personal reasons (*n*=9)
* Due to adverse events (*n*=1)

Discontinued treatment prematurely (*n*=14/53):

* For personal reasons (*n*=14)
* Due to adverse events (*n*=0)

**Enrollment**

*eFigure 1.* Consort flow diagram.

*eFigure 2.* Change in estimated marginal means (EMMs) of total YTP scores for CBT and ESCT from Pre-treatment (Session 1) to Post-treatment (Session 32) broken out by IQ set at covariates of 80, 100, and 120. YTP=Youth Top Problems scale. CBT=cognitive behavioral therapy. ESCT=enhanced standard community treatment.