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Cognitive Pragmatic Treatment via Telepractice (@CPT) for autistic adolescents: A Pilot Study

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Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental clinical condition characterized by difficulties in social communication, restricted interests, and repetitive behaviors¹. Autistic individuals may experience difficulties with communication, ranging from specific language processing (lexical and syntactic) to more complex aspects of pragmatic ability², i.e., the use of language and other expressive means in a given context³⁻⁵. The latter include difficulties in understanding and producing sophisticated phenomena like indirect speech acts, humor, and sarcasm^{6,7}. These difficulties are not limited to the use of language but also involve the use of nonverbal communication, i.e., facial expressions, gestures, and eye contact⁸. Pragmatics is related to Executive Function (EF) and Theory of Mind (ToM), but the nature of this relationship is not completely clear^{9,10}. EF includes cognitive processes like planning, attention, and shifting¹¹, while ToM is the ability to understand one's own and others' mental states¹².

Most studies examined pragmatic development during preschool or school age^{13,14}, while few researchers assessed and trained pragmatic skills during adolescence¹⁵. Additionally, COVID-19 negatively affected national social services and accessibility of health centers, thus making telepractice an interesting opportunity. Telepractice consists of the use of communication technologies (computerized videoconferencing software and internet) in health care¹⁶, and it is a valid and low-cost alternative for conducting online assessments and interventions. Some assessment and rehabilitation protocols focused on social skills^{17,18}, parent training^{19,20}, and specific aspects of communication²¹ were adapted to be used in telepractice with ASD, but to our knowledge, none has a comprehensive target for pragmatics. Given the impact that pragmatic difficulties have on social life, especially in adolescence, it is crucial to improve these aspects.

This study aims to test the effectiveness of the Cognitive Pragmatic Treatment via Telepractice (@CPT) in a group of autistic adolescents. The @CPT was adapted from its face-to-face version for adolescents, a program that has already been shown to be effective in improving pragmatic skills in ASD¹⁵. The effectiveness of @CPT was tested by comparing performance scores on the Assessment Battery for Communication (ABaCo)^{22,23,24} administered pre- and post-training. A range of cognitive (i.e., selective attention, working memory, and cognitive flexibility) and ToM abilities were also assessed before and after training to verify the specificity of training for the target variable, i.e., pragmatics.

Methods

Participants

The experimental group consists of 7 autistic adolescents (1 female) ranging in age from 12 to 18 years ($M=15.00$; $SD=2.08$) and in education from 7 to 13 years ($M=9.57$; $SD=2.14$). Their mean score IQ is 97.57 ($SD=18.87$), assessed with the Raven's Standard Progressive Matrices Italian version²⁵. The participant's training attendance rate was 88.7 %. Another sample of 7 autistic adolescents (1 female) matching the experimental group for age (T-test; $t = 1.54$; $p = .88$), education (T-test; $t = .56$; $p = .58$), and IQ (T-test; $t = 1.20$; $p = .25$) was recruited as a control group. Inclusion criteria were: (1) being native- Italian speakers; (2) age between 12-18 years; (3) diagnosis of verbally fluent ASD previously assigned by qualified clinicians using DSM-5 criteria¹ (4) basic linguistic skills assessed with the language comprehension subtask of BVN 12-18²⁶. Exclusion criteria were (1) history of brain injury or neurological disorder; (2) concurrent participation in Applied Behavior Analysis (ABA) or other communication skills. All participants were recruited in collaboration with Centro Riabilitazione Ferrero (Alba, Italy) and Centro Autismo e Sindrome di Asperger (Mondovi, Italy). Both participants and caregivers provided written informed consent.

Experimental design

Participants in the experimental group were examined before (T0) and after (T1) @CPT. The design also includes a follow-up assessment (3 months later) to verify the stability of the improvement, which is currently ongoing. Participants in the control group underwent the same assessment phases, but instead of @CPT participated in non-communication-related activities (e.g., leisure, sports) with a frequency at least equivalent to that of @CPT.

Assessment Material and procedures

The communicative-pragmatic ability of all participants was assessed by equivalent forms (A and B) of the ABaCo²²⁻²⁴. ABaCo is a validated clinical tool for testing various aspects of pragmatic ability (such as direct and indirect communicative acts, irony, and deceit), both in comprehension and production. It is divided into 4 scales: linguistic, nonverbal/extralinguistic, paralinguistic and contextual. Based on the instructions, each task can be scored as 0 (incorrect answer) or 1 (correct answer). Administration and coding were organized so that each assessment protocol was coded by a different person than the one who administered it, to avoid possible biases in the scores' attribution.

Cognitive abilities were assessed via a selection of tasks of the Neuropsychological Evaluation Battery - BVN 12-18²⁶: Token test²⁷, Expressive vocabulary task²⁸, Digit Span²⁹, Corsi block-tapping test²⁹, Immediate and Deferred Recall test for long-term verbal memory task^{30, 31}, Selective attention²⁹, Tower of London³², Modified card sorting test³³.

Finally, we examined ToM ability using the Strange Stories³⁴ and Reading the Mind in the Eyes³⁵ tasks.

All experimental sessions were video-recorded and analyzed offline by an independent rater. Administration and analysis followed standardized instructions for each task.

Cognitive Pragmatic Treatment via Telepractice (@CPT)

The @CPT is a group training consisting of 15 sessions of 90 minutes each, held once a week. Each session of @CPT focuses on a specific communication topic (see Table 1). Sessions in @CPT are conducted online via videoconferencing with video/audio sharing, the ability to share materials and assignments with both the entire group and each individual participant. All experimental sessions are video-recorded, with participant consent to identify and highlight improvements observed in the last session.

SESSION	TOPIC	CONTENT AND ACTIVITIES
1	INTRODUCTION AND OVERALL COMMUNICATIVE ABILITY	Introduction to @-CPT program goals and structure; Self-introduction of each participant, including the description of any perceived difficulty in daily living communication. Overview of communicative-pragmatic ability using video clips and role playing tasks based on daily living situations
2	LINGUISTIC ABILITY	Videoclips and role playing based on the linguistic expressive modality.
3	EXTRALINGUISTIC ABILITY	Videoclips and role playing based on the gestural modality.
4-5	PARALINGUISTIC ABILITY	Videoclips, facial expression recognition tasks, tone of voice exercises and role playing.
6-7	SOCIAL APPROPRIATENESS	Videoclips and role playing focused on social appropriateness and communicative adequacy in different contexts.
8	CONVERSATIONAL ABILITY	Videoclips, role playing and exercises focused on the use of conversational rules (i.e., turn-taking and topic management).
9	PHONE CONVERSATION	Audioclips and role playing focused on telephone conversational rules (i.e., voice only, no paralinguistic and gestural clues, available in live interactions).
10-11	SOCIAL ABILITY	Videoclips and role playing focused on the ability to formulate meta-representations with respect to one's own and others' mental states.
12	NARRATIVE AND PLANNING	Picture-description task, aimed at eliciting story-telling by providing an adequate amount and type of information.
13-14	OVERALL COMMUNICATIVE ABILITY	Videoclips and role playing focused on the overall pragmatic effectiveness, expressed through all the modalities constituting communicative competence.
15	CONCLUSION, AWARENESS AND FEEDBACK	Feedback and conclusions about the progresses observed during @-CPT program; i.e. showing videorecording of the salient moments along the sessions where the improvements could be detected to each participant during the group session

Table 1. Description of the @CPT protocol: topic, content and activities of each session are explained.

Results

We performed a non-parametric analysis with the Wilcoxon's signed-rank test, to determine whether there were statistically significant differences at ABaCo scores between T0 and T1, in both the experimental and control groups. The same analysis was run to compare cognitive and ToM performances before and after training. The results showed that the pragmatic performance of the experimental group at T1 (after training) was significantly higher than at T0 (before training) as for ABaCo total score, comprehension, and production scales. No significant improvements were detected in the cognitive and ToM tasks, with the only exception of Strange Stories and Modified Card Sorting Test tasks. No differences were found in any of the control group's performance.

The scores obtained by each group on the pragmatic, cognitive, and ToM tasks before and after training, as well as the results of the comparisons, are summarized in Table 2.

	Experimental group				Control group			
	Pre	Post	Z	p	Pre	Post	Z	p
	Score M (SD)				Score M (SD)			
Pragmatic assessment								
ABaCo global score	.69 (.08)	.83 (.07)	2.201	.028	.64 (.11)	.64 (.11)	.169	.866
Comprehension	.66 (.09)	.84 (.06)	2.197	.028	.68 (.12)	.71 (.09)	.338	.735
Production	.72 (.09)	.82 (.09)	2.371	.018	.61 (.16)	.59 (.16)	1.183	.237
Cognitive assessment								
Token test	58.97 (51.98)	71.57 (27.14)	1.219	.223	49.00 (35.32)	55.69 (27.06)	.412	.680
Expressive vocabulary	73.44 (21.55)	74.04 (21.19)	.254	.799	88.45 (17.50)	94.25 (12.88)	.734	.463
Digit span	97.58 (18.65)	91.24 (15.13)	.674	.500	83.90 (19.70)	85.42(14.45)	.000	1.000
Corsi block-tapping	87.82 (29.86)	98.18 (10.47)	.813	.416	91.77 (21.14)	101.65(10.04)	.316	.752
Immediate Recall	68.90 (45.34)	82.85 (23.11)	.676	.499	55.00 (33.68)	78.70 (30.41)	.677	.498
Deferred Recall	87.57 (41.37)	100.02(22.74)	.943	.345	224.58(181.41)	178.04(165.90)	.730	.465
Selective attention	107.68 (6.89)	115.48 (9.56)	1.753	.080	95.48 (8.8)	99.45(15.38)	1.018	.309
Tower of London	94.55(18.02)	97.70 (17.64)	.524	.600	89.22 (16.58)	99.90 (14.07)	1.472	.141
Modified card sorting test	66.30(35.13)	98.08 (11.94)	2.028	.043	87.48(28.04)	99.90 (14.07)	.946	.344
ToM assessment								
Strange Stories	61.81 (28.51)	83.33 (16.66)	2.041	.041	57.09(16.34)	61.90 (23.00)	.412	.680
Reading the Mind in the Eyes task's	61,73 (17.58)	65,81 (7.67)	.730	.465	62,49(10.28)	61,11(11.40)	.542	.588

Table 2. Performance scores in pragmatic, cognitive, and ToM assessments at T0 (before) and T1 (after) of experimental and control groups. Statistically significant results are highlighted.

Discussion

The results show the effectiveness of @CPT training in improving the overall communicative pragmatic performance of the training participants but not in the control group. More in detail, we observed an improvement in the @CTP participants' performance on both comprehension and production scales of ABaCo. The pragmatic improvement observed in the @CPT group did not reflect on the majority of cognitive and ToM performances, with the only exception of Strange Stories and the Modified Card Sorting test. This could be due to a generalization effect of the training activities, where abilities like perspective taking (i.e., ToM), and cognitive flexibility might be indirectly solicited to effectively produce and understand communicative acts.

The results highlight the potential of the telepractice and @CPT in particular, to improve the pragmatic ability in autistic adolescents. The study is ongoing and a more detailed analysis of a larger sample will confirm and strengthen the present results.

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