Social-Cognitive Remediation in Schizophrenia: Generalization of Effects of the Training of Affect Recognition (TAR)

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In the last decade, several social cognitive remediation programs have been developed for use in schizophrenia. Though existing evidence indicates that such programs can improve social cognition, which is essential for successful social functioning, it remains unclear whether the improvements generalize to social cognitive domains not primarily addressed by the intervention and whether the improved test performance transfers into everyday social functioning. The present study investigated whether, beyond its known effects on facial affect recognition, the Training of Affect Recognition (TAR) has effects on prosodic affect recognition, theory of mind (ToM) performance, social competence in a role-play task, and more general social and occupational functioning. Thirty-eight inpatients with a diagnosis of schizophrenia or schizoaffective disorder were randomly assigned to 6 weeks of treatment with the TAR—primarily targeted at facial affect recognition—or Cognitive Remediation Training (CRT)—primarily targeted at neurocognition. Intention-to-treat analyses found significantly larger pre–post improvements with TAR than with CRT in prosodic affect recognition, ToM, and social competence and a trend effect in global social functioning. However, the effects on ToM and social competence were no longer significant in the smaller group of patients who completed treatment according to protocol. Results suggest that TAR effects generalize to other social cognitive domains not primarily addressed. TAR may also enhance social skills and social functioning, although this has to be confirmed. Results are discussed with regard to the need to improve functional outcome in schizophrenia against the background of current evidence from other social cognitive remediation approaches.

Key words: social cognition/cognitive remediation/social outcome/schizophrenia

Introduction

Schizophrenia patients exhibit significant cognitive impairments beyond clinical positive and negative symptoms. These impairments affect a wide range of cognitive domains comprising neurocognitive processes like attention, memory, and executive functions as well as social cognitive processes like social cue perception, affect recognition, attribution, and theory of mind. Although interrelationships between neurocognition and social cognition are described—in particular such that neurocognition influences social cognition—in patients suffering from schizophrenia, impairments in neurocognition and social cognition also exist independently from each other and from psychotic symptoms. In particular, impairments in social cognition have received growing attention in schizophrenia research in recent years. On the one hand, this is due to the assumption that such impairments may have a role in the etiopathogenesis of schizophrenia. In fact, impairments in facial affect recognition—the most frequently investigated area of social cognitive impairments in schizophrenia—have been shown to occur in first-episode patients, to be stable in longitudinal studies independent of the acuity of the schizophrenia to and of the illness duration, and to be stable despite clinically effective treatment. Moreover, there is increasing evidence for impaired processing of emotional faces in individuals at familial high risk for psychosis or in the prodromal state of psychosis, suggesting a role of impaired facial affect recognition as a vulnerability factor or putative endophenotype. On the other hand, the interest in social cognition results from its robust association with poor social and community functioning. Social cognition seems not only to be a mediator, moderator, or both of the known association between neurocognitive impairments and social functioning but also to explain additional variance in functional outcome that cannot be accounted for by...
neurocognition. Poor everyday social functioning affects various areas, such as independent living, initiation, and continuation of interpersonal relationships or vocational functioning, and leisure. As traditional drug and psychosocial treatment in general have only a marginal impact on social functioning and as schizophrenia patients often report these disabilities to be most disturbing, there is an urgent need to find new treatment strategies that enable people with schizophrenia to enhance their functional abilities.

With regard to the close association between cognitive impairments and poor functional outcome, cognitive remediation—in particular that which targets social cognitive impairments—is suggested to be a promising approach to enhance social functioning. Social cognitive remediation programs developed during the last decade can be classified as either targeted or broad based. Broad-based interventions combine a variety of psychosocial approaches, including cognitive remediation, social skills training, and social cognitive skill building, whereas targeted interventions focus on a specific social cognitive domain (eg, emotion perception).

Although social cognitive remediation is still at an early stage of development, the initial efficacy results are encouraging. The existing evidence indicates that improvements in social cognitive processes, which are essential for successful social functioning, can be achieved by both broad based and targeted intervention approaches, whereby the latter almost exclusively address affect recognition. While there are several reports that broad-based interventions improve not only social cognition but also social skills and social functioning, as yet it is less clear whether improvements resulting from targeted interventions generalize to the social cognitive domains not primarily addressed by the intervention and whether improvements in test performance transfer into everyday social functioning. Previous studies merely showed that training effects on facial affect recognition generalized to emotion perception measures different from those used during the training and that an attention-shaping intervention not only improved affect recognition performance but also resulted in slightly improved social behavior. However, as the effect on social behavior failed to reach statistical significance and the training comprised only one session, the question remains whether more extensive targeted interventions may have stronger effects on social behavior and may have an impact also on social cognitive domains not addressed during the treatment.

The aim of the present study was therefore to evaluate possible effects of a 12-session targeted intervention program—the Training of Affect Recognition (TAR)—on outcome measures beyond its primary target of facial affect recognition. The study investigated whether the TAR also affects prosodic affect recognition, theory of mind (ToM) performance, social competence, and social and occupational functioning. A cognitive remediation program (CRT) that primarily addressed neurocognitive rather than social cognitive processes was used as an active control intervention to test for both specific and generalizing effects. The TAR was expected to cause larger improvements than the CRT.

Methods

Design

The study was conducted using a randomized controlled intervention design with pre- and post-training assessments. Participants were randomized to either the TAR intervention or the CRT intervention as an active control. Each of the 2 interventions comprised 6 weeks of training with 2 sessions a week; each session took 45–60 min.

The TAR is a manualized, computer-aided 12-session program that primarily targets impairments in facial affect recognition. It is applied in a small group setting of 2 patients and 1 therapist. The training program comprises both restitution and compensation methods, ie, beyond repeated practice, it also tries to establish alternative strategies of information processing (eg, verbalization, self-instruction, and generation of associations using situational clues and context information) known to be essential for both the efficacy of remediation approaches and the generalization of effects. Further core principles applied in TAR are errorless learning, ie, the avoidance of errors during the training phase; over-learning, ie, frequent repetition of facial features prototypical of basic emotions; and immediate (verbal) positive feedback and feature abstraction, ie, abstraction from individual to prototypical expressions. Identification and discrimination of facial affect items are the core content. During the first 4 sessions, the primary focus is to discriminate the prototypical facial expressions of basic emotions. The features of these emotions are presented by their typical mimic signs (actions units), as described in the Facial Acting Coding System (FACS) and are verbalized using colloquial speech. In the middle part of the TAR, participants are asked to verify their first impression by reasoning and to resort to the alternative strategies learned in the first block in case of uncertainty; nonverbal processing is promoted by matching tasks, and decoding of different intensities of emotional expression is trained by pictures showing different intensity levels (produced by morphing neutral into affective expressions). Training content becomes more complex later on in the intervention, when affect has to be recognized in pictures of social scenes. In the later sessions, the integrated understanding of social scenes is trained by referring patients to context information-like situational background, accompanying nonverbal signs beyond facial expression, and associated cognitions. Also, nonprototypical, mixed emotions, and ambiguous scenes are evaluated by referring to elements of basic emotions and by applying previously learned strategies.
The CRT is comparable to the TAR in all main structural and methodological aspects but primarily targets neurocognitive impairments in attention, memory, and executive functions without addressing any kind of social cognition. The CRT uses existing computer tasks of the software Cogpack Professional (Version 5.9j, Marker Software), supplemented by desk work and accompanied by compensation strategies, as mentioned for the TAR. Both training programs proved to be effective in their respective cognitive target processes in a former randomized controlled trial, i.e., the TAR significantly improved facial affect recognition performance and the CRT significantly improved verbal memory. These effects could be replicated in the current sample; detailed results on the efficacy in facial affect recognition and the durability of treatment effects will be reported elsewhere (Frommann et al, submitted).

Outcome and Control Measures

Facial affect recognition was assessed by a multiple choice labeling task consisting of 24 pictures (i.e., 2 women and 2 men, each expressing the 6 basic emotions of happiness, surprise, anger, fear, disgust, and sadness) from the “pictures of facial affect” (PFA) set. The dependent measure of the PFA test is the total number of correct answers, with a maximum of 24.

Prosodic affect recognition performance was assessed with the Geneva Vocal Emotion Expression Stimulus (GVEESS). The material consists of nonsense sentences in a fantasy language spoken in different emotional tones. For the present study, the test material consisted of 8 sentences each in the emotions, happiness, anger, fear, sadness, and disgust. The total number of correct answers—ranging from 0 to a maximum of 40—was used as the outcome measure.

ToM performance was assessed by a test developed by Brüne, which comprises a series of 6 cartoon picture stories containing 4 pictures each. There are 3 types of stories depicting (1) a scenario where 2 characters cooperate, (2) a scenario where 1 character deceives a second character, and (3) a scenario showing 2 characters cooperating to deceive a third. Each type of story is presented in 2 picture stories. The ToM questionnaire, comprising 35 questions of different levels of complexity, was given to the subjects to test their ability to evaluate the mental states of the characters involved in the cartoon stories. Performance in this questionnaire (0–35 correct answers) was used as the outcome variable.

Social competence was assessed with a role-play task, in accordance with the procedure proposed by Penn and colleagues. A 5-min role play of getting to know an unknown person was videotaped and rated on 5-point Likert scales (derived from) for eye contact, prosody, speech duration, agitation and nervousness, fluency of conversation, gestures, facial expression, and global impression of social competence. The total score of the 8 items—ranging from 8 to a maximum of 40 points—was used as the outcome measure. Videotapes of the role-play task were rated by 3 psychology students who were blind to the assessment point and to treatment condition. The inter-rater reliability of the role-play task was high (r = .82).

The Social and Occupational Functioning Assessment Scale (SOFAS) was used to assess global social functioning.

The severity of current clinical symptoms was assessed by a trained psychotherapist (author N.F.) before and after treatment by using the Positive and Negative Syndrome Scale (PANSS). Nonaffective face recognition was assessed by the Benton Face Recognition Test (BFRT) and premorbid intelligence by a Multiple Choice Vocabulary Test (MWT-B), as control measures at the pretreatment measurement. All assessments were performed blind to treatment condition.

Sample

Thirty-eight inpatients (26 male and 12 female) with a diagnosis of either schizophrenia (n = 31) or schizoaffective psychosis (n = 7) (ICD-10) were randomly assigned to 1 of the 2 treatment conditions (TAR, n = 20; CRT, n = 18). Participants received both a verbal and a written description of all study procedures and provided written informed consent before randomization. The study protocol was approved by the University of Düsseldorf’s institutional ethics committee. Diagnoses were verified by a trained psychotherapist (author N.F.) by using the International Diagnostic Checklist of ICD-10 (IDCL) in a structured clinical interview. At study intake, patients were partly remitted, with a mean PANSS total score of 61.0 (SD = 16.3), a mean negative score of 17.0 (SD = 6.6), a mean positive score of 13.2 (SD = 4.4), and a mean general psychopathology score of 31.8 (SD = 7.4). Seven participants had been admitted for their first episode of psychosis and 3 for their second episode; 13 patients had 2 to 4 previous episodes before admission and 13 had 5 or more previous episodes. The total sample was of normal intelligence (intelligence quotient [IQ]: mean = 102.5; SD = 15.4) and had a mean age of 36.7 (SD = 13.1).

At the pretreatment assessment, there were no significant differences between the TAR and CRT groups with respect to gender distribution, age, intelligence (MWT-B), nonaffective face recognition abilities (BFRT), or clinical status. There were also no significant differences between the two groups in prosodic affect recognition (GVEES), ToM task, social competence (role-play task), or social functioning (SOFAS).

Thirty (15 TAR and 15 CRT) of the 38 participants completed the training phase according to protocol, i.e., they participated in all 12 training sessions and in the posttreatment assessment. The remaining participants dropped out after being discharged from hospital.
treatment because they were not willing or able to come to the hospital twice a week to complete the intervention and assessment. Group comparisons found no significant differences at the pretreatment assessment between the participants who completed treatment and the dropouts with regard to gender distribution, age, intelligence (MWT-B), nonaffective face recognition (BFRT), prosodic affect recognition (GVEESS), ToM, or social competence. However, dropouts were on a lower level of social functioning (SOFAS; dropouts: mean = 58.0, SD = 11.4; completers: mean = 12.6, SD = 4.0; t = -1.71, P = .096) but showed no difference in negative symptoms or general psychopathology. Changes in symptom levels over time did not differ significantly between the treatment conditions (pre–post differences in PANSS negative score: TAR: mean = 1.4, SD = 3.7; CRT: mean = 2.8, SD = 4.5; P = .387; positive score: TAR: mean = 1.9, SD = 4.7; CRT: mean = 0.9, SD = 3.3, P = .549; general psychopathology: TAR: mean = 3.1, SD = 4.4, CRT: mean = 2.0, SD = 4.7, P = .520).

Analyses

Univariate analyses of variance (2 × 2 ANOVA) for repeated measures (group × time) were conducted for each of the 4 outcome measures—prosodic affect recognition, theory of mind, social competence, and social functioning. Data were analyzed according to the intention-to-treat model (ITT), with missing values imputed by respective group means. In order to estimate bias caused by imputation, according-to-protocol analyses also were computed for participants who completed treatment according to the protocol and participated in the post-treatment assessment.

To demonstrate that any improvements in social cognition or functioning were not merely associated with improvements in clinical status, Pearson’s correlation coefficients were calculated between change scores of PANSS subscores and change scores of the PFA task, ToM task, role play, and SOFAS.

In order to analyze whether social cognition measures (facial and prosodic affect recognition and ToM) in our sample were empirically associated with social competence during role play and global social functioning (SOFAS), Pearson’s correlations and regression analyses (stepwise forward models) were performed with pretreatment ITT data from the total sample.

Results

The TAR was an effective intervention to improve affect recognition performance (between-effect size for differential pre–post improvement under TAR vs CRT for facial affect recognition was d = 1.2) (Frommann et al., submitted).

The two-way ANOVA revealed significant group × time interactions in prosodic affect recognition, ToM, and social competence during role play and a trend interaction in global social adjustment (Table 1). All these interactions were due to significantly larger pre–post improvements in the TAR group than in the CRT group (between-effect sizes for differential pre–post improvement under TAR vs CRT: prosody: d = 0.89; ToM: d = 1.14; social competence: d = 0.75; SOFAS: d = 0.58); actually, patients under CRT did not improve at all in prosodic affect recognition, ToM, or social competence. Accordingly, significant main effects of time in prosodic affect recognition and ToM could be traced back only to improvements under TAR, whereas both groups contributed (to a slightly different degree) to a significant time effect in the SOFAS. Improvements in ToM under TAR were large enough to result also in a significant main effect group in this outcome variable.

According-to-protocol analyses for patients completing treatment (n = 15 per group) confirmed the differential improvement of TAR patients in prosodic affect recognition (interaction F = 8.0, P = .009) and ToM (interaction F = 8.3, P = .009); however, there was no statistically significant difference between treatment conditions in social competence (interaction F = 0.2, P = .65) and SOFAS (interaction F = 2.46, P = .13).

Pearson’s correlations were calculated between change scores of PANSS subscores and change scores of the 4 outcome measures to evaluate whether improvements in social cognition or functioning were associated with improvements in clinical status; however, no significant correlations were found. The largest correlation—and the only one to reach a trend level of significance—was observed between the role-play change score and the change score of PANSS negative symptoms (Pearson’s r = .336 P = .081).

The analyses of correlations before treatment revealed a significant relationship between social competence in the role-play task and social functioning (SOFAS; r = .33, P = .043); however, none of the 3 social cognitive measures (facial affect recognition, prosodic affect recognition, and ToM) or any psychopathological measure was significantly associated with the SOFAS. Accordingly, a regression analysis with the SOFAS score as the criterion and social competence, social cognition, and clinical status as potential predictors revealed social competence as the only significant predictor, with 11% explained variance (β = .330, t = 2.095, P = .043).

Social competence in the role-play task was significantly correlated with facial affect recognition (r = .42, P = .010) and negative symptoms (r = -.46, P = .004). The respective regression analysis with social competence as the criterion identified the following three variables as predictors, with a total of 47% explained variance: PANSS negative score (β = -.388, t = -4.187, and P = .000), facial affect recognition (β = .388, t = 3.082,
Prosodic affect recognition in other studies and in the present study is more successful under TAR but not under CRT. Thus, TAR effects also seem to generalize to other social cognitive domains not primarily addressed. However, this might also be interpreted as a direct primary treatment effect since in particular, the last sessions of the TAR contain several tasks that require and exercise thinking about the mental state of other people as well as reasoning processes about social scenes. As mentioned above, such tasks were included with the intention to discuss affect recognition within the context of the situational cues, other affective signs, and the accompanying thoughts of people in such social situations, affective states, or both. Thus, these tasks clearly address not only affect recognition but also ToM, which might explain the “generalization” of training effects also to ToM. The TAR therefore seems to be less targeted than initially intended, and, on the continuum of targeted to broad-based social cognitive remediation approaches, to be a bit closer to those training programs usually considered to be more broad based.

The most interesting effect found in the present study—because it is the ultimate aim of every cognitive remediation program—was the differential improvement in social competence under TAR as compared to CRT; this improvement was accompanied by a corresponding trend toward improvement in social functioning. However, at the same time, this effect was smaller in effect size and less stable than the effects on prosodic affect recognition and ToM. It could be shown only for the ITT sample and not in the smaller subsample of patients completing the treatment period. This instability of the effect seems to be due to both the smaller sample size and the larger variance of the completer sample. Nevertheless, more detailed analyses of the complete data set found notable pre–post improvements in social competence (d = 0.5, ITT: d = 0.69) and social functioning (d = 0.48, ITT: d = 0.65) under TAR. Moreover, in the meantime also, other groups have collected data indicating successful improvement in the social functioning domain under TAR treatment (G. Sachs, Vienna, personal communication). Though altogether these results might be

### Table 1. Means, Standard Deviations (SDs) and Results of 2 × 2-Repeated Measures ANOVA (Time × Group) of Main Outcome Variables

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<th>Variable</th>
<th>Mean (SD)</th>
<th>Univariate Repeated Measures ANOVA</th>
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<td>TAR</td>
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<td>Pre</td>
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<td>Prosodic affect recognition (GVESS)</td>
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<td>Social competence (RPT)</td>
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<td>Social functioning (SOFAS)</td>
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Note: TAR, Training of Affect Recognition; CRT, Cognitive Remediation Training; GVESS, Geneva verbal stimulus set; RPT: role-play task; SOFAS: Social and Occupational Functioning Scale; significant effects are printed in bold.

P = .004, and PANSS total score (β = .570, t = 2.714, P = .010). There were no major differences between results of ITT analyses and according-to-protocol analyses regarding these associations.

### Discussion

The main purpose of cognitive remediation in schizophrenia is to enhance cognitive performance and, by this means, to promote social and occupational functioning. In particular, remediation programs targeting social cognition seem to be more promising with regard to social functioning than programs targeting neurocognition. One example of a social cognitive remediation program is the TAR, which has proven its enhancing effect on facial affect recognition in other studies \cite{36,39} and in the present sample (Frommann et al. submitted). However, effects on other modes of affect recognition, other social cognitive domains, and social functioning have not yet been adequately investigated. The present study shows that the primary effect on recognition of facial affect also generalized to recognition of prosodic affect. This effect appears to be specific for the TAR as no comparable improvement could be observed under CRT. This result is particularly interesting as the TAR does not contain any explicit training component for prosody affect. However, training components regarding facial affect are embedded in the broader context of nonverbal expressive behavior that transmits affective information. Thus, participants are instructed to pay more attention not only to facial signs of affect but also to prosodic signs, gestures, posture, and social situational context. It seems likely that this strategy also has promoted generalization of training effects to recognition of other modes of affect expression.

Moreover, analyses of the present data revealed that, in addition to affect recognition, also ToM performance improved under TAR but not under CRT. Thus, TAR effects also seem to generalize to other social cognitive
taken as a first hint that the TAR may actually enhance social skills and social functioning, for the present, the results should be interpreted with caution. As so far none of the other targeted social cognitive remediation programs have been investigated with respect to possible effects on social outcome, it remains unclear whether such effects always occur together with improvements in social cognition. A recent study that used a more broad-based training approach focusing on several social cognitive domains could not demonstrate clear benefits for social competence. Whether this discrepancy is due to the different treatment approach or to different psychometric or conceptual characteristics of the outcome measures or even may hint at nonficiency of social cognitive remediation in improving functional capacity needs further clarification. Thus, respective results for the TAR need to be confirmed in future studies. Nevertheless, the trends observed so far seem noteworthy as they were obtained at the end of only 12 training sessions over 6 weeks. The generalization of newly acquired social cognitive abilities into social behavioral skills and daily social life may only start during the treatment period and may take a longer period of practice after the end of the intervention before it is fully effective. An outpatient rather than an inpatient setting may be more suitable for such practicing. This hypothesis needs further investigation with follow-up evaluations after the end of treatment. A prerequisite for such prolonged transfer is the stability of primary treatment effects on social cognition. Such stability of treatment effects beyond the end of treatment has recently been shown for the TAR (Frommann et al, submitted).

Another reason for the smaller effects of TAR treatment on social skills and functioning than on social cognition may be seen in the fact that social cognition—though significantly associated with social outcome—only explains a relatively small amount of outcome variance. In their recent meta-analysis, Fett et al reported a common variance of about 16% for social cognition and global functional outcome. In the current study, facial affect recognition explained 22% of the variance in social competence as a proxy of social skills but was not significantly related to the global measure of social functioning (SOFAS). However, social competence was significantly associated with global social functioning, with a common variance of about 14%, suggesting that social skills have a moderator function between social cognition and social outcome, as described by Brekke et al. Such relatively small amounts of common variance suggest that cognitive remediation may be only one component of comprehensive efforts to enhance social functioning in schizophrenia.

More broad-based approaches often favor a combination of training in social cognitive skills and social behavioral skills. Unfortunately, approaches that primarily focus on social cognitive remediation have either not yet reported effects of such a combined training on functional outcome (Social Cognition Enhancement Training) or only investigated relatively small samples (Social Cognition and Interaction Training, Social Cognition Training Program), so that firm conclusions cannot be drawn. Approaches that focused primarily on social skills training indeed proved to have moderate effects on functional outcome, with effect sizes between $d = 0.3$ and $d = 0.5$, as assessed by performance-based measures of social and daily living skills or by global measures of community functioning. However, as these approaches primarily focused on social behavioral skills, whereas social cognitive skills are usually targeted only implicitly, it remains unclear what kind of ingredients caused the effects and whether explicitly targeting both social behavioral and social cognitive skills would be more effective. This critique also applies to the most broad-based approaches comprising neurocognitive and social cognitive remediation in combination with social skills training, like the Integrated Psychological Therapy (IPT) or the Cognitive Enhancement Therapy (CET). Both programs proved to enhance social functioning and suggested that the combination of neurocognitive remediation, social cognitive remediation, and social skills training is more effective than each of these components alone. However, as the treatment components have not been systematically investigated with respect to their single and combined effects, the active components of these programs are as yet unknown. Moreover, in particular, the CET comprises more than 100 h of treatment over up to 2 years, which might be suitable only for selected patients with high compliance and might conflict with the often restricted possibilities of psychiatric care. Thus, it seems worthwhile to continue developing less extensive treatment programs with a known structure of active components to understand the mechanisms of generalization from treatment content to improvement in daily life and thus to enhance functional outcome in people suffering from schizophrenia.

Funding

This study was part of the German Research Network on Schizophrenia and was funded by the German Federal Ministry for Education and Research (BMBF grant no. 01GI0502).

Acknowledgments

The authors would like to thank Rainer Banse, Klaus Scherer, and Heiner Ellgring for administering the GVEESS, Martin Brüne for administering the ToM test, David Penn for administering the role-play test, and our students Maike Peltzer, Julia Fleiter, and Anne Steinbring for their support in conducting the study. The authors thank also Jacquie Klesing, ELS, for editing assistance with the manuscript.
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