

Exploring Relation between Cognitive Perceptual Deficits and Functional Performance in Schizophrenia- A Mini Review

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ABSTRACT

Schizophrenia is a serious mental illness that affects how a person thinks, feels and behaves. People with schizophrenia may seem like they have lost touch with reality, which causes significant distress for the individual, their family members and friends. If left untreated, symptoms of schizophrenia can be persistent and disabling. Cognitive perceptual impairment is a core feature of schizophrenia and several studies have demonstrated that it is strongly related with daily functioning and other functional outcomes. Several RCTs have demonstrated that patients with schizophrenia improve negative symptomatology after cognitive rehabilitation. The prevalence of schizophrenia affects patient's participation in functional tasks. The aim of this review was to explore literature; published in the past 15 years in the area of cognitive perceptual deficits in schizophrenia and functional impairments caused due to it. We also explored the strategies for remediation. In this integrated mini review, published researches were reviewed including RCTs, observational studies, interventional, experimental, correlational studies, case reports and systematic reviews. To conclude, it was analyzed that dysfunctions in working memory, attention and abstract thinking and problem solving have been extensively documented in schizophrenia, which may improve slightly with remedial strategies.

KEYWORDS: Schizophrenia, Cognitive – perceptual deficits, Functional performance, Occupational Therapy, Cognitive rehabilitation.

ARTICLE DETAILS

Published On:
19 November 2021

Available on:
<https://ijmscr.org>

INTRODUCTION

Schizophrenia is a serious mental illness that affects how a person thinks, feels, and behaves. People with schizophrenia may seem like they have lost touch with reality, which causes significant distress for the individual, their family members, and friends. If left untreated, the symptoms of schizophrenia can be persistent and disabling. Schizophrenia is typically diagnosed in the late teen years to the early thirties and tends to emerge earlier in males than females. A diagnosis of schizophrenia often follows the first episode of psychosis, when individuals first display symptoms of schizophrenia. Gradual changes in thinking, mood, and social functioning often begin before the first episode of psychosis, usually starting in mid-adolescence. Psychotic symptoms include altered perceptions (e.g., changes in vision, hearing, smell, touch, and taste), abnormal thinking, and odd behaviours. People with psychotic symptoms may lose a shared sense of

reality and experience themselves and the world in a distorted way.

Specifically, individuals typically experience:

- Hallucinations, such as hearing voices or seeing things that aren't there
- Delusions, which are firmly held beliefs not supported by objective facts
- Thought disorder, which includes unusual thinking or disorganized speech

Negative symptoms include loss of motivation, disinterest or lack of enjoyment in daily activities, social withdrawal, difficulty showing emotions, and difficulty functioning normally. Specifically, individuals typically have:

- Reduced motivation and difficulty planning, beginning, and sustaining activities
- Diminished feelings of pleasure in everyday life
- "Flat affect," or reduced expression of emotions via facial expression or voice tone

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• Reduced speaking

Cognitive symptoms include problems in attention, concentration, and memory. For some individuals, the cognitive symptoms of schizophrenia are subtle, but for others, they are more prominent and interfere with activities like following conversations, learning new things, or remembering appointments. Specifically, individuals experience:

- Difficulty processing information to make decisions
- Problems using information immediately after learning it
- Trouble focusing or paying attention¹

Psychological treatments designed to remediate and or to bypass cognitive impairments are important to pursue and maximize the outcomes for patients with schizophrenia. Cognition enhancing treatments may result in improved functional outcome. Cognitive perceptual impairment is a core feature of schizophrenia and several studies have demonstrated that it is strongly related with daily functioning and other functional outcomes. Several RCTs have demonstrated that patients with schizophrenia improve negative symptomatology after cognitive rehabilitation. Individuals with schizophrenia are known to suffer from various cognitive difficulties. One of the important diagnostic characteristics of these patients is reality testing impairment which can be related to poor perceptual processing. Cognitive impairments stabilize after illness onset, at least until older adult life. It has been suggested that there is change in IQ and in individual cognitive functions after the first episode of schizophrenia. Cognitive impairment in schizophrenia may also have modest correlations with negative and disorganization symptoms and weak correlation with positive symptoms. Schizophrenia can diminish motivation, initiative, mood and emotional expression. These contribute to the category of negative symptoms. Schizophrenia patients often struggle with area of visual perception which are seen in contrast, contour, form and motion processing. Researchers suggest how abnormal visual perception might cause hallucinations but there is a hypothesis that involves dysfunctional feedback signals from later stages in visual processing and cognition. These signals carry information about the visual environment and prior knowledge about what a stimulus might be. If these signals are deficient then, the brain may try to fill in the gaps of missing information and perceive things that are not there. Impairment in visual integration has been linked to increase in disorganized symptoms, poorer premorbid social functioning, and presence of childhood trauma in schizophrenia, illness severity and chronicity. Patients receiving additional visual processing training show higher improvement on measures of visual learning, working memory and social cognition psychopathology as have been conceptualized recently. Phenomenological investigations in Occupational Therapy draws on the emerging discipline of occupational science which asserts that engagement in meaningful and satisfying

occupations improves social inclusion, functioning and self respect contributing to health and wellbeing.¹⁷

RATIONALE

The prevalence of schizophrenia in India is about 3/1000 individuals. It is more common in men, and in terms of age of onset, men tend to be younger by an average of about five years than women when they develop schizophrenia. The symptoms of schizophrenia affect patient's participation in Functional tasks.⁶

This clearly indicates that there is a need to find out the cause for functional deficits seen in this devastating mental disorder. The literature is inclined towards the fact that cognitive perceptual deficits can be the root cause for functional deficits seen in schizophrenia. Occupational Therapy science involves theories on remediation of cognitive perceptual deficits. This review aims to explore the connection between these factors.

AIMS

To review the literature on:

- 1) Prevalence of cognitive perceptual deficits in schizophrenia.
- 2) Functional impairments caused due to cognitive perceptual deficits in patients with schizophrenia.
- 3) Remedial strategies for cognitive perceptual dysfunction in schizophrenia.

OBJECTIVES

Identify the causes for functional deficits in schizophrenia and explore strategies of intervention through review of literature.

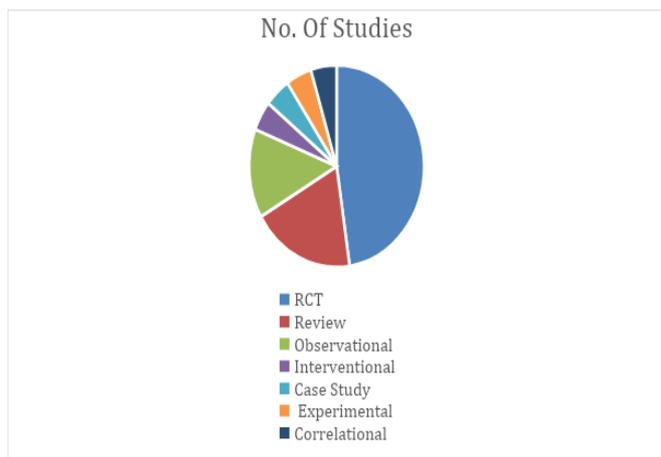
INCLUSION CRITERIA

1. Published research articles in past 15 years about Cognitive Perceptual Deficits in Schizophrenia
2. Research studies conducted specifically on diagnosed cases of schizophrenia.
3. All types of study designs eg. RCT, case reports, case series.
4. Studies conducted in both acute and chronic phases of schizophrenia.
5. Both genders.

EXCLUSION CRITERIA

1. Studies done on other psychotic disorders like brief psychotic episodes, neurosis.
2. Schizophrenia with other neurological affectations.
3. Studies conducted in childhood onset schizophrenia (as those are the developmental years in terms of development cognitive perceptual function).

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METHODOLOGY

Study Design: Integrated Mini Review

Search strategy:

- 1) Freely available published articles were searched through PubMed, Research Gate, Google Scholar, Cambridge Core, Science direct, Frontiers, Research features and AJP databases.
- 2) The following keywords were used: 'Schizophrenia', 'Cognitive, Perceptual dysfunction', 'Cognitive function', 'Neuropsychiatry', 'Occupational performance', 'Functional outcome', 'Functional performance', 'Occupational therapy'.
- 3) Cross references were also searched.
- 4) Articles were scanned according to inclusion and exclusion criteria.
- 5) Further the articles were analyzed according to the aims and objectives.
- 6) Conclusion of selected articles was drawn.

In total of 53 articles were identified through database search, cross references and table of relevant journals. After screening for all articles, 32 articles were rejected as they did not comply with inclusion criteria. Finally data extracted from 21 articles was considered for analysis.

RESULTS

Study Design	No. Of Studies
RCT	10
Review	4
Observational	3
Interventional	1
Case Study	1
Experimental	1
Correlational	1

DISCUSSION

Cognitive perceptual deficits are prevalent in Acute as well as Chronic phase of Schizophrenia.¹⁹

Since the earliest description of schizophrenia by Kraepelin “dementia praecox”, cognitive deficits have been noted as core components of the illness. Recently the symptoms of schizophrenia are classified as positive symptoms, negative symptoms, cognitive symptoms, and affective symptoms. Cognitive symptoms are recognized as a major symptom domain. Efforts have been taken to address the cognitive symptoms in the management of schizophrenia. However, the conventional pharmacological, biological as well as psychological interventions fall short to adequately address the cognitive deficits. Hence, attempts to design specific strategies that improve the cognitive deficits are essential.

Some researchers suggest that these deficits usually get unnoticed; however they leave an impact on the functionality of a person with Schizophrenia. Pharmacological treatments don’t treat Cognitive perceptual deficits effectively. These deficits can be remediated through psychotherapy.¹⁹ Studies also suggest that these cognitive perceptual deficits in Schizophrenia are usually irreversible and can be attributed to the symptomatology (delusions, hallucinations) in Schizophrenia.¹⁹

Deficits in everyday living skills and social skills are associated with the pervasive disability seen in schizophrenia.¹⁷ Changes in perception have rarely been considered an important starting point for investigations concerning the cognitive deficits and symptoms of schizophrenia. Alterations in perceptual organization in schizophrenia are related to altered self experience and sometimes result in the development of delusion. Patients with neurophysiological deficits are likely to have impairments in measures of functional capacity which in turn are associated with impairments in the ability to form and maintain relationships in the community.⁷

Commonest perceptual deficits in schizophrenia are with reference to visual perception. Visual integration deficits are seen in contrast, contour, form and motion processing in schizophrenia. Impairments in visual integration have been linked to increase in disorganized symptoms, poorer premorbid social functioning, presence of childhood trauma in schizophrenia and illness, severity and chronicity.¹¹

Abnormal contour detection is more likely to be due to the pathophysiology of schizophrenia rather than genetics. It has been shown that schizophrenia patients exhibit weaker surround suppression than healthy controls. They are less affected by what is surrounding a visual target. The genetic basis of visual deficits in schizophrenia could be used as a biomarker for improving the diagnosis and risk prediction.

One of the prominent expressions of schizophrenia is impaired reality testing. The reality testing of patients with schizophrenia is found to be significantly slower and more variable than those of age matched comparison subjects

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across all conditions in a study. This finding is well known in the literature and confirms the general psychomotor slowing associated with the disorder.¹⁷

Cognitive dysfunction in Schizophrenia may result from a complex interplay between an early static neuropathology and dynamic age related process. Reduction in IQ may also be seen in schizophrenia patients. There is minimal association between change in positive as well as negative symptoms and change in cognition. The schizophrenia group exhibited decline in verbal knowledge and memory.² The association between form perception and cognitive dysfunction underscore the interconnectedness between visual perceptual sensory input and higher cognitive processing and in particular with prefrontal executive processing.

Social cognition, which reflects domains of emotions and social perception; and social function, community function and interpersonal problem solving is mediated by cognitive abilities. The link between cognition and social function is fully mediated by social cognition in case of schizophrenia. Social cognition has unique relations to functional outcome as it is more proximal to social function. It represents a valuable target for intervention. Interventions at cognitive level could have an impact on both cognition and social cognition.¹⁵

Patients with schizophrenia have deficits in the ability to combine stimulus elements into coherent object representation. These deficits may represent a core disturbance in the generation of coherent cognitive and neural activity.

Cognitive remediation and social cognitive training could potentially be enhanced by including less demanding tasks involving auditory and visual sensory modalities. Cognitive remediation techniques can be divided into two groups based on the understanding of neurocognitive science i.e compensatory and restorative.

Teaching compensatory skills requires participants to have insight into their difficulties, assessing an individual's strength and weaknesses as well as understanding learning style, learning preferences best suited for the person.

On the other hand, restorative methods are based on the knowledge derived from cognitive neuroscience and neural plasticity research. These strategies involve attempts to correct a specific neural deficit using the capacity of the brain to develop and repair throughout the whole life.⁴

Cognitive remediation for schizophrenia is defined as “an intervention based on behavioural training that intends at mending the cognitive processes (executive functions, attention, memory, social cognition or metacognition) in terms of its durability and making it more generalized”. The recent definition of cognitive remediation emphasizes the improvement of functional outcomes by addressing the cognitive deficits through the scientific principles of learning enhancement. Cognitive remediation can be achieved

through therapy in various contexts to improve functioning of daily activities.¹⁹

Another way of classifying cognitive remediation techniques is top-down and bottom-up techniques. Top-down (feedback) approach involves improving single and specific neurocognitive complex skills like strategy coaching, training of higher order metacognitive skills and executive functions. Bottom-up (feed forward) approaches start with basic neurocognitive skills like attention, pre attentive perceptual biasing and perceptual skills. Cognitive training also utilizes various learning strategies like errorless learning, scaffolding, masses practice, positive reinforcement and information processing strategies.

Various cognitive remediation techniques are:-

Cognitive Enhancement Therapy (CET): It is designed in a way to provide enriched cognitive experiences through targeted and integrated neurocognitive and social-cognitive training. The main focus is on enhancing both “bottom-up” processing of critical social stimuli, with “top-down” executive control over distracting information and emotional arousal.

Neuropsychological Educational Approach to Rehabilitation (NEAR): A stepwise training approach. Followed by the computerized session of training, participants discuss in detail the strategies that they have learned while practicing cognitive tasks and how these skills may be helpful in real life activities.

Cognitive Adaptation Training (CAT): Home delivered cognitive rehabilitation strategy which is designed to train cognition in order to solve daily life problems, specific and concrete to each individual.

Brain Fitness Program (BFP): BFP restores and amplifies auditory perception and working memory processing using six exercises of increasing complexity. Initially formants in speech like phonemes, words and sentences are to be mastered. Verbal instructions are remembered in sequences and then processing of the real world scenarios is done.

Computer Assisted Cognitive Remediation (CACR): Improves various cognitive domains and social cognition in schizophrenia.

There is a relationship between social cognition and common objects and activities, which is a measure of community integration and assesses participation in common activities. In the presence of psychiatric symptoms, a negative correlation between social cognition and functioning may be a reflection of the individual's awareness of the effects their illness has on their social interaction. Evidence suggests that significant improvement in social functioning occurs when cognitive training and other psychosocial rehabilitation programs are administered, together in addition to adoption of strategy coaching approaches based on learning strategy.

Rehabilitation protocols that target visual perception include: Computer based learning- processing of perceptually grouped patterns. It is based upon repeated engagement of a

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discrimination task that requires perceptual organization. The regulated rate of increased difficulty thereby allows exposure to multiple trials within participants' ability, which reinforces processes associated with perceptual organization. In addition, feedback is provided. Providing feedback as part of the training protocol thereby improves the effectiveness of training as stimulus difficulty advances to higher levels.

Instrument Enrichment (IE) Therapy- cognitive strategies: It enables participants to quickly and effectively extract visual information such as regularities in stimulus structure that are relevant to task demands. It employs therapist-guided learning. IE programme modules used here target relationships among stimulus components, thereby focusing therapy on perceptual organization.

In a research study, authors concluded that the majority of participants appeared to enjoy IE Therapy and some patients indicated that they found activities to be a positive experience in the referred study.³

Occupational therapists need to implement new challenging occupational opportunities and environments for clients with schizophrenia thereby maximizing their participation in society. Occupational engagement and accompanying process of achieving meaning are central to the process of recovery of self and development of self identity. It is vital for Occupational therapists to help people with schizophrenia move from disengagement, by providing meaningful occupations, in encouraging environments that facilitate self definition and meet the internal needs of being.

Future research is indicated to evaluate the role of cognitive remediation in other symptoms of schizophrenia. It will be important to develop cognitive remediation that can be delivered in community settings and to train clinicians for its implementation. Hence further work could develop comprehensive approaches to cognitive remediation that incorporate key therapeutic principles from a variety of treatment modalities.¹⁹

DESCRIPTIVE ANALYSIS OF KEYPOINTS

Analysis done under the components of Visual perception, Cognition, Remedial strategies and Functional performance.

A) VISUAL PERCEPTION

2 Reviews titled:

1) A randomized controlled trial of executive functional training compared with perceptual training for schizophrenia spectrum disorders, Best, M. W., Milanovic, M., Iftene, F., & Bowie, C. R. (2019)⁸

2) Visual perception and its impairment in schizophrenia, Butler, P. D., Silverstein, S. M., & Dakin, S. C. (2008)¹¹

3 RCTs titled:

1) Visual impairment affects the perception of reality: Visual processing deficits, Ariela Gigi, Daniela Karni and Oren Eilam (2015)⁹

2) Perception and executive deficits of chronic Schizophrenia patient in attentional and intentional tasks, Frecska, E., Symer, C., White, K., Piscani, K., & Kulcsar, Z¹⁰.

3) Abnormal visual motion processing in schizophrenia: A review of research progress, Chen Y. (2011)¹⁶

4) Deficits of Tactile Passive Perception Acuity in Patients With Schizophrenia, Liu, D., Fan, H. Z., Zhao, W. X., Wang, Y. H., Li, D., Wu, J. L., Yan, T. Y., & Tan, S. P. (2020).¹⁸

Schizophrenia affects visual perception in the form of contour, contrast and motion processing. Visual Processing deficits involve areas of the dorsal pathway of the visual system and areas of parietal and prefrontal regions leading to reduction in gain control and integration in schizophrenia. Fundamental level of the organization of meaning is disrupted in schizophrenia. The onset of schizophrenia halts the normal development of the visual system. The genetic basis of visual deficits in schizophrenia could be used as a biomarker, improving diagnosis and risk prediction.^{8,9,10,11,15,18}

B) COGNITION

1 RCT titled:

Cognitive change in schizophrenia and other psychoses in the decade following the first episode, Zanelli, J., Mollon, J., Sandin, S., Morgan, C., Dazzan, P., Pilecka, I., Reis Marques, T., David, A. S., Morgan, K., Fearon, P., Doody, G. A., Jones, P. B., Murray, R. M., & Reichenberg, A. (2019)²

1 Correlational:

Cognitive-perceptual deficits and symptom correlates in first-episode schizophrenia, Oosthuizen, P. P., Emsley, R., & Kidd, M. (2017)²¹

Studies say that there is a considerable decline in cognitive function in adult schizophrenia patients. Cognitive impairments are already present at the first episode and continue to decline after illness. There is a decline in IQ and measures of verbal knowledge as well. Processing speed and executive function impairments, that are already present at the first episode, remain stable. Thought disorder and form perception are related with cognitive dysfunction in the first episode of schizophrenia. The association between form perception and cognitive dysfunction underscore the interconnectedness between visual perceptual sensory input and higher cognitive processing.^{2,21}

C) REMEDIAL STRATEGIES

2 RCTs titled:

1) Remediation of perceptual organisation in schizophrenia, Kurylo, D. D., Waxman, R., Silverstein, S. M., Weinstein, B., Kader, J., & Michalopoulos, I. (2018)³

2) A randomized controlled trial of executive functional training compared with perceptual training for schizophrenia spectrum disorders, Kurylo, D. D., Waxman, R., Silverstein, S. M., Weinstein, B., Kader, J., & Michalopoulos, I. (2018)⁸

1 Interventional article titled:

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Cognitive deficits in schizophrenia: Understanding the biological correlates and remediation strategies, Adarsh Tripathi, Sujita Kumar Kar¹⁹

Computer training and Instrument Enrichment (IE) therapy, both improve perceptual organization ability. Improvement in cognition was observed by executive training. Evidence indicates that cognitive rehabilitation therapy (CRT) results in significant improvement in cognitive function, social cognition, independent living skills and social adjustments. A study supports the hypothesis that occupational therapy is associated with clinical improvement in patients with schizophrenia and also has a direct relationship with improvements in psychological symptoms.^{3,8,19}

D) FUNCTIONAL PERFORMANCE

2 Observational articles titled:

1) Schizophrenia Research, Tsuang MT, Van Os J, Tandon R, et al¹

2) Engagement in occupations among men and women with schizophrenia, Bejerholm, U., & Eklund, M. (2006)¹⁴

1 Experimental article titled:

Social cognitive deficits in schizophrenia and their relationship to clinical and functional status, Fiszdon, J. M., Fanning, J. R., Johannesen, J. K., & Bell, M. D. (2013).²⁰

A study suggests that one third of schizophrenia patients achieve significant and lasting improvement; one third improve but have intermittent relapses and residual disability and one third are severely and permanently incapacitated. Social dimension was added to occupational performance when patients used mass media or listened to music. The relationship between social cognitive measures and measures of symptoms and functioning are weakly supported.^{1,14,20}

CONCLUSION

Dysfunctions in working memory, attention, processing speed, visual and verbal learning with substantial deficit in reasoning, planning, abstract thinking and problem solving have been extensively documented in schizophrenia.¹⁹

Cognitive deficits are prominent, despite clinical stability in patients with schizophrenia and it probably attributes to disability.

Social cognition refers to the ability to correctly process information as carried by socially relevant stimuli and to use it to generate socially appropriate responses in situations. It includes perception of emotions, assigning people to specific mental states and decision making.

Difficulties in social functioning leading to social isolation, interpersonal problems exacerbate symptoms, and hence promote relapses. These can further significantly impair quality of life and interfere with rehabilitation processes and vocation. Occupational therapists play a role in improving social functioning by providing occupational opportunities. Cognitive training programs are interventions that seek to enhance the neurocognitive and socio-cognitive skills in

patients relevant to their recovery goals. There are varieties of the cognitive remediation programs available at present. There can be an improvement in functional performance of patients with Schizophrenia if identified and intervened in time for cognitive perceptual deficits.¹⁹

Further research in this area may suggest promising outcomes.

LIMITATIONS

- 1) Type of schizophrenia was not considered.
- 2) Articles mentioning impact of cognitive perceptual deficits on Functional performance in Schizophrenia were limited in number.
- 3) Articles specifying the role of Occupational Therapy in remediation of Cognitive perceptual deficits in Schizophrenia were few in the current review.

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