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EFFICACY OF NEUROPLASTICITY INTERVENTION MODULE (NIM) IN CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD) ACROSS MULTIPLE DOMAINS OF INDIAN SCALE FOR ASSESSMENT OF AUTISM (ISAA)

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Abstract

Major Aim of the present research is to study "Efficacy of Neuroplasticity Intervention Module (NIM) in Children with Autism Spectrum Disorder (ASD) Across Multiple Domains of Indian Scale for Assessment of Autism (ISAA)".

Total 30 children having mild level of Autism Spectrum Disorder have been selected from two different Institutions of Ahmedabad City.

For the data collection, Indian Scale for Assessment of Autism (ISAA) was administered in individual setting before and after introducing Neuroplasticity Intervention Module (NIM).

Practice of Neuroplasticity Intervention Module was executed with daily practice of one hour for two consecutive months.

Scoring was done as per the scoring key of the manual of "Indian Scale for Assessment of Autism" (ISAA)

To analyze the data paired t-test was used.

Results indicates that significant effects of Neuroplasticity Intervention Module were observed in social relationships and reciprocity; emotional responsiveness; speech-language & communication; behaviour patterns; sensory aspects and the cognitive component domains among children with Autism Spectrum Disorder.

Significant improvement was found in all six (6) domains of Autism Spectrum Disorder, with consistent, structured and repeated Neuroplasticity Intervention Module Practice.

INTRODUCTION

Autism Spectrum Disorder (ASD) is a multifaceted Neurodevelopmental disorder. According to the DSM-5TR the diagnostic criteria for ASD are –

(a) Persistent deficits in social communication and social interaction e.g. social-emotional reciprocity, non-verbal communicative behaviour, etc.

(b) Restricted, repetitive patterns of behaviour, interests or activities, as stereotyped or repetitive motor movements insistence on sameness, restricted-fixed interests, hyper or hypo reactivity to sensory inputs.

These core features originate in the early development period though they may become fully manifest later.

This disorder leads to clinically significant impairment in social, academic, occupational & adaptive functioning and cannot be better accounted for by Intellectual Disability (ID) or Global Developmental Delay (GDD).

From a neurodevelopmental perspective Autism Spectrum Disorder (ASD) is conceptualized as a spectrum disorder or condition as it reflects wide variability in symptom severity, cognitive profiles, sensory processing and functional outcomes.

Emerging evidence underscores ASD as a disorder of a typical brain connectivity and neural plasticity.

This perspective supports the use of Neuroplasticity Based Interventions aimed at strengthening functional brain networks through structured, repetitive and developmentally targeted experiences to enhance multidomain functioning.

Neuroplasticity – Neuroplasticity is the brain's ability to change and adapt due to experience. It is an umbrella term referring to the brains ability to change, reorganize or grow neural networks.

These changes occur as a result of –

- Neurogenesis (creation of new neurons)
- Neural pruning (removal of unnecessary neural connections)

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Neuroplasticity enriches and redevelops the neural pathways for restructuring and rewiring of the brain.

IMPORTANCE OF NEUROPLASTICITY

- It helps the brain to adapt and change
- The ability to learn new things.
- The ability to enhance existing cognitive capabilities.
- Recovery from less active and dysfunctional region of the brain.
- Strengthening areas where function is lost or declined.
- Improvements that can boost brain fitness / strengthening e.g. focus, memory & processing speed.

NEUROPLASTICITY AND CHILDREN HAVING ASD

Children with ASD exhibit altered neural connectivity affecting communication, social cognition, sensory processing, motor coordination and executive functioning.
Neuroplasticity Based Intervention Module aim to stimulate adaptive neural pathways through targeted activities thereby promoting functional improvement across developmental domains of Autism Spectrum Disorder.

SIX DOMAINS ALIGNED WITH NEUROPLASTICITY INTERVENTION MODULE

1. Social Relationship and Reciprocity
Repeated and structured social interaction and play based activities facilitate experience – dependent plasticity within neural circuits responsible for social cognition, thereby enhancing social reciprocity, shared attention and appropriate social responsiveness.

2. Emotional Responsiveness / Reciprocity
Systematic training in emotional recognition, expression and reciprocal emotional exchange promoted adaptive reorganization of limbic – prefrontal networks resulting in improved emotional understanding, regulation and responsiveness.

3. Speech, Language and Communication
Interventions targeting listening, expressive language, non-verbal cues, facial expressions, gestures and turn taking strengthen functional connectivity within language and social communication networks, supporting effective communicative competence.

4. Behaviour Patterns
Structured flexibility training and response modulation activities support neuroplastic changes within fronto-striatal circuits, contributing to a reduction in stereotyped, repetitive and rigid behavioral patterns.

5. Sensory Aspects
Graded Sensory Integration and Modulation activities facilitate plastic adaptation in thalamocortical and sensory cortical pathways, leading to improved sensory processing, tolerance and regulation.

6. Cognitive Component
Cognitive training exercises focusing on attention, memory, executive functioning, imitation and problem solving enhance plasticity within prefrontal and parietal networks, strengthening learning efficiency and adaptive cognitive functioning.

REVIEW OF LITERATURE

Autism and abnormal development of brain connectivity (Belmonte et al., 2004) Belmonte and colleagues (2004) provided one of the early and influential syntheses arguing that autism spectrum disorder (ASD) can be conceptualized as a disorder of altered brain connectivity. Drawing on functional and anatomical imaging studies, they proposed a pattern of local hyper connectivity coupled with reduced long-range connectivity across cortical systems. This connectivity profile was linked to impaired integration of information across distributed networks particularly those supporting social cognition, language, and executive control. The authors discussed how such aberrant connectivity could arise from altered developmental plasticity: either excessive activity-dependent synaptic stabilization locally or insufficient pruning and strengthening of long-range projections during critical periods. Importantly, Belmonte et al. emphasized that connectivity differences vary across individuals and developmental stages, accounting for the heterogeneity of ASD. Their framework helped reorient research from focal regional abnormalities toward network-level and timing-based models of neurodevelopment. Subsequent longitudinal and multimodal imaging work has refined these ideas, but the central notion that atypical experience-dependent wiring underlies key ASD features remains influential (Belmonte et al., 2004).
Activity-dependent neuronal signalling and autism spectrum disorder (Ebert & Greenberg, 2013) Ebert and Greenberg (2013) synthesized molecular and genetic evidence linking ASD to disruptions in activity-dependent neuronal signalling—mechanisms by which neuronal firing patterns drive gene expression and synaptic remodeling. They highlighted how many ASD-associated genes converge on pathways that regulate synaptic

protein synthesis, trafficking, and structural plasticity. Disruption of activity-dependent transcription factors and translational control (for example, via FMR1, MECP2, or TSC1/2 mutations) can impair experience-dependent refinement of circuits during sensitive periods. Ebert and Greenberg argued that understanding the points of convergence among ASD risk genes provides targets for therapeutic modulation of plasticity—for instance, by normalizing aberrant protein synthesis or rebalancing excitation–inhibition. The review also stressed the importance of developmental timing: interventions that modulate activity-dependent signalling may have different effects depending on whether they are applied during windows when circuits are most plastic. Overall, this work cemented a molecular-to-circuit perspective on ASD grounded in neuroplasticity principles (Ebert & Greenberg, 2013).

The intense world theory — hyper-plastic microcircuits in ASD (Markram et al., 2010) Markram and colleagues (2010) proposed the Intense World Theory, which posits that in some individuals with ASD, microcircuits become hyper-reactive and hyper-plastic, leading to enhanced local processing but reduced capacity for integration. According to the theory, heightened synaptic potentiation and exaggerated local learning create an 'intense' subjective world characterized by sensory hypersensitivity, social withdrawal, and repetitive behaviors. The authors argued that such hyper-plasticity could be maladaptive: while it might enhance certain perceptual skills, it can overwhelm systems required for flexible, context-dependent behavior. The theory places emphasis on the balance between local circuit strengthening and the need for regulatory homeostatic processes; if homeostasis fails, runaway plasticity produces atypical developmental trajectories. Experimental work in animal models showing local circuit hyper-excitability and atypical habituation provides partial empirical support. Clinically, the theory suggests interventions should both scaffold coping with heightened sensitivity and promote mechanisms that restore inhibitory control and network-level integration (Markram et al., 2010).

Synaptic dysfunction in neurodevelopmental disorders (Petersen & Rubenstein, 2015) Petersen and Rubenstein (2015) reviewed evidence that many neurodevelopmental disorders—including ID and ASD—share common synaptic pathologies. They detailed how mutations affecting synaptic scaffolding proteins, adhesion molecules, and presynaptic release machinery disrupt synaptic transmission and plasticity mechanisms like long-term potentiation (LTP) and long-term depression (LTD). Such synaptopathies compromise the capacity for experience-dependent remodeling that is essential for learning and adaptive behavior. The authors emphasized that synaptic dysfunction can manifest at multiple levels: molecular, structural (e.g., spine morphology), and circuit-level dynamics. They also discussed the translational potential of targeting synaptic mechanisms—either pharmacologically or via behavioral enrichment—to restore plasticity. The review thus situates synaptic dysfunction as a central node linking genetic lesions to cognitive and behavioral phenotypes (Petersen & Rubenstein, 2015).

Excitatory–inhibitory balance and plasticity in autism models (Gogolla et al., 2014) Gogolla et al. (2014) synthesized findings from various mouse models of autism showing that disruptions in the balance between excitation and inhibition (E/I balance) are a recurring feature. Such E/I imbalances impact plasticity: for example, insufficient inhibition during development can prolong critical periods or lead to hyper-reactive microcircuits, whereas excessive inhibition can truncate plastic windows. The authors reviewed evidence that restoring inhibitory function—through genetic, pharmacologic, or environmental manipulations—can rescue some behavioral phenotypes in model systems. This work underscores how circuit-level homeostasis is central to appropriate plasticity and suggests therapeutic avenues that target interneuron development or GABAergic signaling to normalize developmental trajectories (Gogolla et al., 2014).

Dendritic spine pathology in autism (Hutsler & Zhang, 2010) Hutsler and Zhang (2010) reviewed morphological studies reporting increased dendritic spine densities—often with immature spine profiles—on cortical projection neurons in individuals with ASD. Spine abnormalities implicate disruptions in structural plasticity, including impaired pruning and maturation processes that normally sculpt functional circuits during development. These morphological signatures correlate with synaptic transmission irregularities and may underlie cognitive and perceptual differences observed in ASD. The work supports the idea that interventions promoting spine maturation and appropriate synaptic turnover could ameliorate specific functional impairments, though translating structural changes into clinical gains remains an ongoing challenge (Hutsler & Zhang, 2010).

STATEMENT OF PROBLEM

In present research researcher has tried to know the effect of Neuroplasticity Intervention Module (NIM) on various dimensions of Autism Spectrum Disorder (ASD) such as social relationship and reciprocity, emotional responsiveness, speech language and communication, behaviour patterns, sensory aspects and cognitive component among Children with Autism Spectrum Disorder. The problem of this research is "Efficacy of Neuroplasticity Intervention Module (NIM) in Children with Autism Spectrum Disorder (ASD) Across Multiple Domains of Indian Scale for Assessment of Autism (ISAA)"

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OBJECTIVES

1. To know the effect of Neuroplasticity Intervention Module training of on Social Relationship and Reciprocity among Children with Autism Spectrum Disorder.
2. To know the effect of Neuroplasticity Intervention Module before training and after training on Emotional Responsiveness among Children with Autism Spectrum Disorder.
3. To know the effect of Neuroplasticity Intervention Module before training and after training of Neuroplasticity Intervention Module on Speech, Language and Communication among Children with Autism Spectrum Disorder.
4. To know the effect of Neuroplasticity Intervention Module before training and after training of Neuroplasticity Intervention Module on Behaviour Patterns among Children with Autism Spectrum Disorder.
5. To know the effect of Neuroplasticity Intervention Module before training and after training of Neuroplasticity Intervention Module on Sensory Aspects among Children with Autism Spectrum Disorder.
6. To know the effect of Neuroplasticity Intervention Module before training and after training of Neuroplasticity Intervention Module on Cognitive Component among Children with Autism Spectrum Disorder.
7. To know the effect of Neuroplasticity Intervention Module before training and after training of Neuroplasticity Intervention Module on Overall Multidomain of Indian Scale for Assessment of Autism (ISAA).

HYPOTHESIS

Ho_1 There is no significant effect of Neuroplasticity Intervention Module on Social Relationship and Reciprocity among Children with Autism Spectrum Disorder.
Ho_2 There is no significant effect of Neuroplasticity Intervention Module on Emotional Responsiveness among Children with Autism Spectrum Disorder.
Ho_3 There is no significant effect of Neuroplasticity Intervention Module on Speech Language and Communication among Children with Autism Spectrum Disorder.
Ho_4 There is no significant effect of Neuroplasticity Intervention Module on Behaviour Pattern among Children with Autism Spectrum Disorder.
Ho_5 There is no significant effect of Neuroplasticity Intervention Module on Sensory Aspects among Children with Autism Spectrum Disorder.
Ho_6 There is no significant effect of Neuroplasticity Intervention Module on Cognitive Component among Children with Autism Spectrum Disorder.
Ho_7 There is no significant effect of Neuroplasticity Intervention Module on Overall Multidomain of Indian Scale for Assessment of Autism (ISAA).

SAMPLE

Total 30 Children with mild level of Autism Spectrum Disorder were selected through purposively sampling from two different institutions of Ahmedabad City.

VARIABLE

In present research efficacy of Neuroplasticity Intervention Module was considered as independent variable and 6 various domains of Autism Spectrum Disorder such as Social Relationship and Reciprocity, Emotional Responsiveness, Speech Language and Communication, Behaviour Patterns, Sensory Aspects & Cognitive Component considered as dependent variables.

TOOL

Indian Scale for Assessment of Autism (ISAA)

PROCEDURE OF DATA COLLECTION

For data collection, prior permission was taken from two institutions, and consent was also taken from all parents of children having Autism Spectrum Disorder. After establishing the rapport with the Children, In pre-test before introducing Neuroplasticity Intervention Module, Indian Scale for Assessment of Autism (ISAA) was administered on individual among selected Children having Autism Spectrum Disorder. After completion of pre-test data collection, practice of Neuroplasticity Intervention Module was given to children's in individual setting, daily one hour for two consecutive months. After completion of data collection of both pre and post session scoring was done as per the scoring key Indian Scale for Assessment of Autism (ISAA). Data was arranged in appropriate tabular form for Statistical Analysis.

STATISTICAL ANALYSIS

To analyse the data paired t-test was used.

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Table-1
Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Social Relationship and Reciprocity

Group	N	Mean	SD	't'	Level of Significance
Pre	30	19.07	1.46	12.07	0.01
Post	30	16.03	1.83		

Table No.1 showing the Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Social Relationship and Reciprocity. The t value of Social Relationship and Reciprocity of Children with Autism Spectrum Disorder is 12.07 which is significant at 0.01 level. So, the null hypothesis "There is no significant effect of Neuroplasticity Intervention Module on Social Relationship and Reciprocity of Children with Autism Spectrum Disorder" is rejected. It indicates that significant effect found regarding practice of Neuroplasticity Intervention Module on social relationship and reciprocity among children with Autism Spectrum Disorder. Table-1 shows the mean score of before practice of Neuroplasticity Intervention Module on Social Relationship and Reciprocity among Children with Autism Spectrum Disorder is 19.07 and mean score of after practice of Neuroplasticity Intervention Module on Social Relationship and Reciprocity among Children with Autism Spectrum Disorder 16.03 with SD 1.46 and 1.83 respectively. Here result indicates that practice of Neuroplasticity Intervention Module could help in enhancing the Social Relationship and Reciprocity among Children with Autism Spectrum Disorder.

Table-2
Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Emotional Responsiveness

Group	N	Mean	SD	't'	Level of Significance
Pre	30	14.47	2.08	5.80	0.01
Post	30	12.10	1.40		

Table No.2 showing the Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Emotional Responsiveness. The t value of Emotional Responsiveness of Children with Autism Spectrum Disorder is 5.80 which is significant at 0.01 level. So, the null hypothesis "There is no significant effect of Neuroplasticity Intervention Module on Emotional Responsiveness of Children with Autism Spectrum Disorder" is rejected. It indicates that significant effect found regarding practice of Neuroplasticity Intervention Module on Emotional Responsiveness among children with Autism Spectrum Disorder. Table-2 shows the mean score of before practice of Neuroplasticity Intervention Module on Emotional Responsiveness among Children with Autism Spectrum Disorder is 14.47 and mean score of after practice of Neuroplasticity Intervention Module on Emotional Responsiveness among Children with Autism Spectrum Disorder 12.40 with SD 2.08 and 1.40 respectively. Here result indicates that practice of Neuroplasticity Intervention Module could help in enhancing the Emotional Responsiveness among Children with Autism Spectrum Disorder.

Table-3
Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Speech, Language and Communication

Group	N	Mean	SD	't'	Level of Significance
Pre	30	20.63	2.04	7.39	0.01
Post	30	19.70	2.26		

Table No.3 showing the Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Speech, Language and Communication. The t value of Speech, Language and Communication of Children with Autism Spectrum Disorder is 7.39 which is significant at 0.01 level. So, the null hypothesis "There is no significant effect of Neuroplasticity Intervention Module on Speech, Language and Communication of Children with Autism Spectrum Disorder" is rejected. It indicate that significant effect found regarding practice of Neuroplasticity Intervention Module on Speech, Language and Communication among children with Autism Spectrum Disorder. Table-3 shows the mean score of before practice of Neuroplasticity Intervention Module on Speech, Language and Communication among Children with Autism Spectrum Disorder is 20.63 and mean score of after practice of Neuroplasticity Intervention Module on Speech, Language and Communication among Children with Autism Spectrum Disorder 19.70 with SD 2.04 and 2.26 respectively. Here result indicates that practice of Neuroplasticity Intervention Module could help in enhancing the Speech, Language and Communication among Children with Autism Spectrum Disorder.

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Table-4
Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Behaviour Pattern

Group	N	Mean	SD	't'	Level of Significance
Pre	30	20.50	2.29	12.67	0.01
Post	30	15.97	1.88		

Table No.4 showing the Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Behaviour Pattern. The t value of Behaviour Pattern of Children with Autism Spectrum Disorder is 12.67 which is significant at 0.01 level. So, the null hypothesis "There is no significant effect of Neuroplasticity Intervention Module on Behaviour Pattern of Children with Autism Spectrum Disorder" is rejected. It indicates that significant effect found regarding practice of Neuroplasticity Intervention Module on Behaviour Pattern among children with Autism Spectrum Disorder. Table-4 shows the mean score of before practice of Neuroplasticity Intervention Module on Behaviour Pattern among Children with Autism Spectrum Disorder is 20.50 and mean score of after practice of Neuroplasticity Intervention Module on Behaviour Pattern among Children with Autism Spectrum Disorder 15.97 with SD 2.29 and 1.88 respectively. Here result indicates that practice of Neuroplasticity Intervention Module could help in enhancing the Behaviour Pattern among Children with Autism Spectrum Disorder.

Table-5
Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Sensory Aspects

Group	N	Mean	SD	't'	Level of Significance
Pre	30	13.03	1.47	11.72	0.01
Post	30	11.33	1.40		

Table No.5 showing the Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Sensory Aspects. The t value of Sensory Aspects of Children with Autism Spectrum Disorder is 11.72 which is significant at 0.01 level. So, the null hypothesis "There is no significant effect of Neuroplasticity Intervention Module on Sensory Aspects of Children with Autism Spectrum Disorder" is rejected. It indicates that significant effect found regarding practice of Neuroplasticity Intervention Module on Sensory Aspects among children with Autism Spectrum Disorder. Table-5 shows the mean score of before practice of Neuroplasticity Intervention Module on Sensory Aspects among Children with Autism Spectrum Disorder is 13.03 and mean score of after practice of Neuroplasticity Intervention Module on Sensory Aspects among Children with Autism Spectrum Disorder 11.33 with SD 1.47 and 1.40 respectively. Here result indicates that practice of Neuroplasticity Intervention Module could help in enhancing the Sensory Aspects among Children with Autism Spectrum Disorder.

Table-6
Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Cognitive Components

Group	N	Mean	SD	't'	Level of Significance
Pre	30	13.47	1.68	11.00	0.01
Post	30	12.00	1.29		

Table No.6 showing the Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Cognitive Components. The t value of Cognitive Components of Children with Autism Spectrum Disorder is 11.00 which is significant at 0.01 level. So, the null hypothesis "There is no significant effect of Neuroplasticity Intervention Module on Cognitive Components of Children with Autism Spectrum Disorder" is rejected. It indicates that significant effect found regarding practice of Neuroplasticity Intervention Module on Cognitive Components among children with Autism Spectrum Disorder. Table-6 shows the mean score of before practice of Neuroplasticity Intervention Module on Cognitive Component among Children with Autism Spectrum Disorder is 13.47 and mean score of after practice of Neuroplasticity Intervention Module on Cognitive Components among Children with Autism Spectrum Disorder 12.00 with SD 1.68 and 1.29 respectively. Here result indicates that practice of Neuroplasticity Intervention Module could help in enhancing the Cognitive Components among Children with Autism Spectrum Disorder.

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Table-7
Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Overall Multidomain of Indian Scale for Assessment of Autism (ISAA)

Group	N	Mean	SD	't'	Level of Significance
Pre	30	101.50	3.74	28.85	0.01
Post	30	87.30	3.53		

Table No.7 showing the Mean, SD and 't' value of practice of Pre and Post Test of Neuroplasticity Intervention Module on Cognitive Components. The t value of Overall Multidomain of Indian Scale for Assessment of Autism (ISAA) is 28.85 which is significant at 0.01 level. So, the null hypothesis "There is no significant effect of Neuroplasticity Intervention Module on Overall Multidomain of Indian Scale for Assessment of Autism (ISAA)" is rejected. It indicates that significant effect found regarding practice of Neuroplasticity Intervention Module on Overall Multidomain of Indian Scale for Assessment of Autism (ISAA). Table-7 shows the mean score of before practice of Neuroplasticity Intervention Module on Overall Multidomain of Indian Scale for Assessment of Autism among Children with Autism Spectrum Disorder is 101.50 and mean score of after practice of Neuroplasticity Intervention Module on Overall Multidomain of Indian Scale for Assessment of Autism (ISAA) 87.30 with SD 3.74 and 3.53 respectively. Here result indicates that practice of Neuroplasticity Intervention Module could help in enhancing the Overall Multidomain of Indian Scale for Assessment of Autism (ISAA).

CONCLUSION

The result indicates that the practice of Neuroplasticity Intervention Module significantly improves and enhances Overall Multidomains such as Social Relationship and Reciprocity, Emotional Responsiveness, Speech, Language and Communication, Behaviour Pattern, Sensory Aspects and Cognitive Components among Children with Autism Spectrum Disorder.

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