

Occupational therapy management of children with cerebral palsy through the three-track reasoning process

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Abstract

Occupational therapy practice requires clinical reasoning as a crucial element in assessing, diagnosing, and planning intervention. The case study discusses how three-track reasoning procedural, interactive and conditional was applied in the management of a 5-year-old child with spastic quadriplegic cerebral palsy. Procedural reasoning (based on physical deficits), interactive reasoning (involvement of the child and caregiver), and conditional reasoning (social and environmental contexts) were used to assess, plan interventions, and implement therapy. Results showed increases in functional independence, fine motor control, writing and caregiver handling. This paper has underscored the importance of three-track reasoning in holistic occupational therapy practice with children and the importance of considering cognition and metacognition during treatment design.

Keywords: Cerebral Palsy; Clinical Reasoning; Three-Track Reasoning; Pediatric Occupational Therapy; Case Study

1. Introduction

Clinical reasoning is complex, dynamic, and context-based thinking, which is the foundation of professional practice in healthcare fields. It entails the combination of knowledge, competencies, values, and contemplative abilities to process clinical data and help make decisions in complicated and frequently ambiguous scenarios (Levett-Jones et al., 2010; Higgs and Jones, 2008). It goes beyond the problem-solving which is linear and involves both analytical and intuitive thinking actions in providing responsive and personalized care (Mattingly and Fleming, 1994).

In its simplest form, clinical reasoning involves a circle of actions, involving the following processes, acquisition of cues, information processing or assimilation, problem identification, setting of goals, planning of intervention, implementation, evaluation of outcomes and reflective practice (Levett-Jones et al., 2010; Simmons, 2010). Reflection (in-action, on-action) is especially of great importance because it enables those involved in practice to constantly improve their logical thinking and adapt to changing clinical situations (Schoen, 1983; Unsworth, 2004).

Clinical reasoning is vital in the upholding of professional autonomy, accountability, and clinical competence. It allows practitioners to provide safe, evidence-based, and client-centered interventions and overcome the complexities of the real-world practice (Higgs et al., 2019). Moreover, it facilitates the positive communication and decision-making processes in multidisciplinary teams, improves collaborative care and patient outcomes (Carrier et al., 2015). Clinical thinking as a phenomenon is inherently complex and can be divided into multiple types, which present different lenses

of clinical reasoning that include the identification and categorization of the client condition, depending on clinical collaborations (Schell and Schell, 2008; Higgs and Jones, 2008) using clinical data: Diagnostic reasoning emphasizes the identification and description of the client condition, relying on clinical information and presentation characteristics. Scientific reasoning - is the use of theoretical knowledge, research studies and biomedical knowledge to influence assessment and intervention (Unsworth, 2004; Neistadt, 1998). Hypothetico-deductive reasoning - involves formulating numerous hypotheses and testing them in a systematic way by conducting a clinical investigation (Elstein et al., 1978; Higgs and Jones, 2008). Narrative reasoning - focuses on the personal narrative of the client, experiences and sense-making procedures (Mattingly & Fleming, 1994; Clark, 1993). Pragmatic reasoning is a reasoning that places importance on time, resources, environment and institutional constraints (Schell and Schell, 2008; Unsworth, 2004). Ethical/moral reasoning treats ethical dilemmas and facilitates value-based, client-based decision-making (Barnitt and Partridge, 1997; Edwards et al., 2002). Collaborative reasoning - deals with shared decision-making (with clients, families, and interdisciplinary team members) (Carrier et al., 2015; Schell and Schell,). Predictive reasoning - aims at future prognosis, potential future progressions of functionality, and focuses on anticipations (Unsworth, 2004; Higgs et al., 2019). One of them is three-track reasoning, which is an integrative and comprehensive model, especially relevant to occupational therapy practice. It combines various levels of reasoning into 3 tracks: Procedural reasoning which deals with diagnosis, assessment procedures and evidence-based intervention planning (Mattingly & Fleming, 1994; Schell and Schell, 2008). Interactive reasoning - aims at establishing therapeutic relationships with the client, listening to their point of view and engaging them (Taylor, 2008; Mattingly and Fleming, 1994). Conditional reasoning - is the process where the past, present and future of the client are incorporated into the broader social and environmental environment to allow practitioners to go beyond reductionist practices and form a holistic picture of the client as an occupational being (Fleming, 1991; Unsworth, 2004). This is especially significant in the case of pediatric cases like cerebral palsy, where motor disabilities are integrated with the developmental, psychosocial, family, and environmental factors (Case-Smith and O'Brien, 2015). Three-track reasoning assists in allowing flexible, context-sensitive, and family-focused intervention planning, congruent with modern occupational therapy models. This paper thus utilises the three-track clinical reasoning model to inform the occupational therapy management of a child with cerebral palsy in a way that provides a comprehensive, evidence based and client-oriented approach addressing performance both in terms of functional and meaningful contribution to daily living. To apply three-track reasoning in the clinical management of a child with cerebral palsy, while exploring and critically analyzing the clinical reasoning process through a case study to determine the most appropriate reasoning approach.

2. Literature Review

Cerebral palsy (CP) is mapped as a set of permanently acquired non-progressive motor and postural disorders which are as a result of the displacement of the developing fetal or infant brain (Edward Taub, 2004). These neurological disorders usually go hand in hand with disruption of sensation, cognition, communication, and behavior, which influence significantly the functioning performance (Case-Smith, 2010). CP has been used across the world with an estimated prevalence of between 1.4 to 2.4 per 1,000 live births, rendering it to be among the most prevalent childhood physical disabilities on the planet (Case-Smith, 2010). Backing up to Bangladesh, the number of children with severe disabilities is reported to be 2.6 million but there are currently the tiniest chances to access any speculative educational services, and only around 1,500 children in Bangladesh have access to them (Khandaker et al., 2015).

CP etiology is also multifactorial, including both Prenatal and perinatal risks like birth asphyxia, bilirubin, encephalopathy, intrauterine infections, traumatic brain injury, congenital brain malformations, placental insufficiency, and maternal adverse health conditions (Case-Smith, 2010). These heterogeneous etiological factors lead to the difference in clinical manifestation and functional impairment among affected children (Case-Smith, 2010). The abnormalities of muscle tonality could contribute to the classification of cerebral palsy into spastic, athetoid (dyskinetic) and flaccid cerebral palsy with its characteristic of motor features (Case-Smith, 2010). Classification can also be done by topographical distribution, this case describes the degree of limb involvement with hemiplegia being the mildest and quadriplegia, the worst; this is the case that refers to total involvement (Case-Smith, 2010). Severity scales also help clinicians in identifying functional impairments and in making interventions (Case-Smith, 2010). CP is usually diagnosed between 18 months and 5 years of age by employing complete clinical evaluation, which includes developmental history, neurological and standardized assessment tools (Case-Smith, 2010). The magnetic resonance imaging (MRI), computed tomography (CT) and electroencephalography (EEG) are frequently used neuroimaging tools to determine abnormalities in the brain as well as to promote accurate diagnosis (Case-Smith, 2010).

Treatment of CP is multidisciplinary and holistic, comprising pediatricians, neurologists, orthopedic surgeons, and rehabilitation experts, including physical therapists, occupational therapists, and speech-language therapists (Case-Smith, 2010). This integrated strategy is expected to deliver functional outcomes, increase autonomy, and positively impact children with CP (Case-Smith, 2010). In this context, occupational therapy is very important in ensuring

functional performance through the elimination of deficits in fine and gross motor skills, sensory processing and involvement in activities of Daily living (ADLs) (Case-Smith, 2010). To support the overall development of the child and his social interaction, OT therapists use occupation based and client-centered interventions to help the child to engage in meaningful activities (Case-Smith, 2010).

3. Case Description

A 5-year-old female patient was referred to pediatric occupational therapy services by a multidisciplinary team to have a thorough evaluation and intervention. Her family has a history of consanguinity marriage and has a primary caregiver, the socio-economic and educational background information are well documented as part of an assessment. The improvement plan included subjective and objective elements in the assessment process, and active participation by the caregiver. The subjective findings indicated that the child was delivered by home delivery and at term without complications. However developmental history showed marked motor delays with rolling around 9 months and independent sitting at age around 2 years and independent ambulation not yet accomplished. Also, the child showed the tendency to use the left hand, experiencing the inability to hold it appropriately, which could be an indicator of possible problems with fine motor control and the functionality of hands.

3.1. Objective Assessment

Table 1 Baseline Clinical and Functional Assessment Findings

Domain	Findings
Sensory Skills	Normal (tactile, visual, auditory, vestibular, proprioceptive)
Neuromuscular Status	Mild flexor tone in Upper Limb (U/E), increased tone in Lower Limb (L/E); active Range of Motion in U/E, passive ROM in L/E within normal range
Gross Motor Skills	Can sit, crawl, cruise along furniture; difficulty walking due to poor balance
Transitional Movements	Can roll, pivot prone to sit; needs total support from hands during sit-to-stand
Postural Control	Normal
Clinical Observation	Finger deformities in both hands
Primitive Reflexes	Diminished
Fine Motor Skills	Poor, left-hand dominance, palmar grasp, poor bilateral use, poor in-hand manipulation
Occupational Performance	Needs maximum assistance (feeding, dressing, toileting, bathing)
Cognitive & Visual Skills	Normal
Behavior	Normal
Oral Motor Control	Normal

3.2. Diagnosis

Spastic quadriplegic cerebral palsy

3.3. Clinical Reasoning Application

Information was perceived and interpreted through the integration of knowledge derived from occupational therapy theory, practical training, and prior clinical placements. The assessment process was conducted ethically, with informed consent obtained and active collaboration with the caregiver to ensure a comprehensive understanding of the child's functional abilities and context. Initially, a hypothesis of diplegic cerebral palsy was formulated; however, the extent of upper extremity involvement remained unclear, acting as a confounding factor. Following further observation and detailed history taking, the clinical hypothesis was refined to spastic quadriplegic cerebral palsy. Clinical reasoning was guided by a three-track approach. Procedural reasoning focused on identifying physical impairments and selecting appropriate interventions targeting neuromuscular tone, as well as gross and fine motor functions. Interactive

reasoning emphasized engagement with both the child and caregiver, facilitating rapport building and tailoring interventions to align with the child's interests and the family's context. Conditional reasoning incorporated broader social, familial, and environmental considerations, particularly in planning for meaningful participation and school integration.

3.4. Hypothetico-Deductive Reasoning

Table 2 Clinical Reasoning and Hypothesis Testing Using Elstein's 3-Point Scale

Hypothesis	Cue Interpretation (Elstein 3-point scale)	Modified Hypothesis	Final Decision
Guillain Barre Syndrome	0	Diplegic CP	Spastic Quadriplegic CP
Diplegic CP	-1	Quadriplegic CP	Quadriplegic CP
Quadriplegic CP	+1	Quadriplegic CP	Spastic Quadriplegic CP
Encephalitis	0	-	-

3.5. Intervention and Treatment Plan

The intervention plan was guided by a physiological frame of reference, incorporating neurodevelopmental approaches, specifically the Bo-bath Approach and Rood Approach, alongside the Model of Human Occupation (MOHO) to ensure a holistic, occupation-centered perspective. The short-term goals focused on promoting independence in upper body dressing within 12 sessions and enabling self-feeding with supervision within 10 sessions. Long-term goals emphasized achieving participation in daily living activities with supervision or set-up within 10 months period and facilitating school integration with supervision within 3 months. Treatment interventions included functional gross motor skill training and transitional movements such as sit-to-stand to enhance postural control and mobility. Hand function was addressed through tendon gliding exercises, retrograde massage, finger mobilization, and inhibition techniques. Bilateral and symmetrical hand activities such as ball throwing, rope play, marble games, and puzzle boards were incorporated to improve coordination and engagement. Additionally, pre-writing and fine motor exercises were implemented to support school readiness. Caregiver education and active engagement were integral components of the intervention process. However, challenges were encountered in establishing rapport with the child and addressing the caregiver's physical limitations and memory difficulties. To mitigate these barriers, modifications included the development of a pictorial diary to support caregiver recall and adherence, conducting school-based occupational therapy sessions with appropriate permission, and consistently involving the caregiver in each therapy session to enhance carryover and participation.

3.6. Outcomes

Table 3 Post-Intervention Outcomes in Occupational Performance

Domain	Achieved Outcome
Dressing	Upper body independently
Fine Motor Skills	Improved bilateral hand use, pre-writing
Writing	Improved
Feeding	Able to feed with supervision
Caregiver Skills	Improved handling and guidance

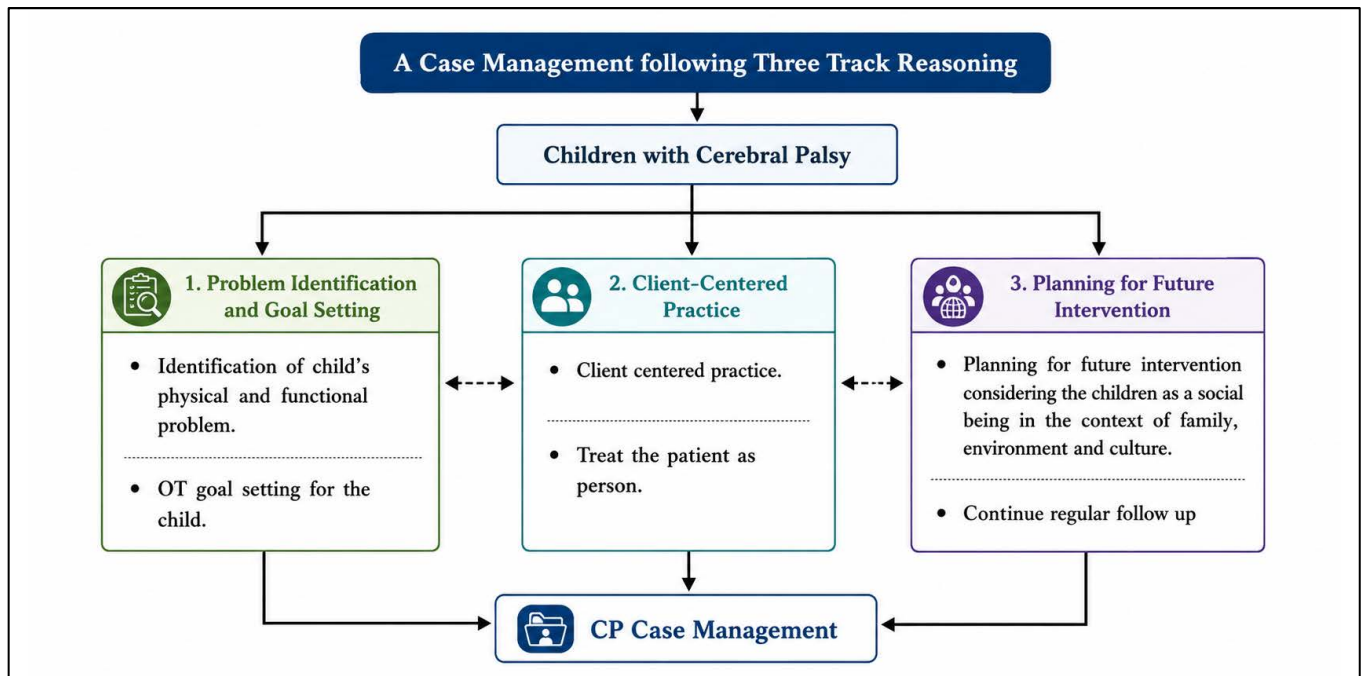


Figure 1 Cerebral Palsy case management following three track reasoning

4. Discussion

Three-track clinical reasoning was particularly suited for this case, as it enabled the therapist to simultaneously address multiple dimensions of the child's needs within a holistic framework (Fleming, 1991; Schell & Gillen, 2019). Procedural reasoning facilitated the identification and remediation of physical deficits through structured assessment and intervention planning, ensuring that biomechanical and performance-related challenges were systematically addressed (Pedretti & Early, 2019; Trombly, 1995).

Interactive reasoning supported the development of a therapeutic alliance by actively engaging both the child and caregiver in meaningful and contextually relevant therapy processes, thereby enhancing motivation, participation, and adherence to intervention (Taylor, 2020; Mattingly & Fleming, 1994). This collaborative engagement is essential in pediatric occupational therapy, where family-centered practice significantly influences outcomes (Case-Smith et al., 2015).

Conditional reasoning allowed the therapist to consider the broader social, cultural, and environmental context, including family dynamics, caregiving capacity, and environmental barriers, which are critical in shaping occupational performance and long-term rehabilitation outcomes (Schell & Gillen, 2019; Kielhofner, 2008). This forward-thinking and context-sensitive reasoning ensured that interventions remained adaptable and sustainable over time (Unsworth, 2017).

Compared to pattern recognition or hypothetico-deductive reasoning alone, three-track reasoning provided a more comprehensive and integrative approach, enabling the therapist to move beyond symptom-focused intervention toward holistic, client-centered care (Unsworth, 2017; Higgs et al., 2019). While pattern recognition may expedite decision-making in familiar cases and hypothetico-deductive reasoning supports analytical problem-solving, neither independently captures the complexity of client-centered occupational therapy practice (Schell & Gillen, 2019).

Furthermore, novice practitioners particularly benefit from integrating both cognitive and metacognitive processes to enhance clinical reasoning skills, allowing for reflective practice and informed selection of theoretical frameworks, models, and intervention approaches (Higgs et al., 2019; Schön, 1983). The integration of these reasoning strategies supports the development of professional competence and promotes evidence-based, contextually responsive occupational therapy practice (Taylor, 2020; Unsworth, 2017).

5. Conclusion

This study highlights the importance of adopting a holistic and client-centered approach in occupational therapy practice. By integrating multiple dimensions of clinical reasoning and considering the physical, psychosocial, and environmental contexts, the findings emphasize the value of comprehensive rehabilitation strategies. The results contribute to the growing body of evidence supporting contextually responsive and evidence-based occupational therapy interventions, particularly within Low-Tech resource settings. Future research is recommended to further explore the applicability of these approaches across diverse populations and clinical conditions.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Statement of ethical approval

This study was conducted in accordance with established ethical principles for research involving human participants. Informed consent was obtained from all participants prior to data collection, ensuring their voluntary participation and right to withdraw at any stage without consequence. Confidentiality and anonymity of the participants were strictly maintained throughout the research process.

Statement of informed consent

Informed consent was obtained from individual participant included in the study.

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