

# Intensive Physiotherapy Interventions in Speedy Recovery of Sub-acute Stroke: A Case Series

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## ABSTRACT:

**Introduction:** Intensive physiotherapy interventions have shown good recovery in stroke if applied to stable patients who can tolerate it. Influence of enriched environment on intensive physiotherapy interventions after acute care has not been studied in low-resource contexts, and therefore, we reported outcome of the interventions in multiple cases with stroke in Nepalese context and cultural background. **Case reports:** Three patients in sub-acute stage of stroke were admitted in intensive physiotherapy treatment unit where the environment was therapeutically enriched. The therapist-administered interventions were intensive for each domain of impairment and activity limitations, every day for six days a week. Patients were trained to carry out caregiver-assisted practice or self-practice in enriched environment. Training demonstrated visible and measurable outcome in all cases. **Conclusion:** Intensive physiotherapy interventions in an enriched environment promoted good recovery in short period in stroke. The interventions applied, and the principles adopted were based on the established evidence, and therefore findings of this study may support for its feasibility and applicability.

**Keywords:** Enriched environment, Intensive physiotherapy intervention, Stroke, Sub-acute

## INTRODUCTION:

Intensive physiotherapy interventions (IPI) showed good recovery in stroke if applied to stable patients who can tolerate them.[1,2] The sub-acute stage is better for IPI as it is safe compared to very early phase, and it has a defined 'plastic window' during which injured brain is primed with physiotherapy interventions.[3,4] Additionally, self-practice in an enriched environment (EE) reinforces therapist-administered interventions (TAI) for better and faster recovery. In high-resource context, patients receive institution-based physiotherapy after acute care (14 days to 38 weeks) which is non-

existent in low-resource context.[1,5] Therefore, this study reported outcome of IPI administered in EE in Nepal.

## CASE REPORT:

Three patients in sub-acute phase (<1 month) of stroke were admitted in Intensive Physiotherapy Treatment Unit(IPTU) where the environment was therapeutically enriched with an aim to administer evidence-based, problem-specific TAI primed with EE. The IPTU has been equipped in such a way that caregivers or patients could continue practicing as per prescription with the aim to achieve added effect on the TAI through patient-regulated exercises, increased therapy time, group training, family participation, task oriented training, and socialization.[6] The unit consisted of two sections: one for TAI and another for self-practice to the patients. It was made sure that all the requirements

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such as equipment, materials and space required for exercises as per therapist’s prescription were available in the self-practice section. Patients could practice individually or in a group. Self-assessment materials and objects were available so that patients could check performance outcome themselves which motivates them to continue self-practice. The space was enough to do exercises and was comfortable (beds and resting chairs were available) to take rest in between the sessions whenever required. The self-practice section used to be 24-hour open so that patients could do exercises whenever they felt comfortable. Individual diary was maintained in the section so that each patient or his/her care giver could record to make sure that they did self-practice as per the prescription. Additional self-practice in an EE not only reinforces TAI by promoting recruitment of

endogenous pathways, endothelial cell proliferation, angiogenesis, neurogenesis and functional recovery but also saves therapists’ time and effort.[7]The physiotherapy interventions were called intensive when active interventions were prescribed for  $\geq 45$  minutes per session or  $\geq$  two sessions per day lasting at least 30 minutes each with  $\geq 5$  days/week with additional self-practice.[3,4] In this case study, the IPI was modified to make appropriate to Nepalese individuals to their cultural context and background based on a study by Adhikari et al.,[4] in which protocol was adapted for Nepalese patients with stroke and the concept of intensive interventions was integrated in deriving action observation-execution and motor training protocol.

The TAI was administered as per patient-

Table 1. Case description and interventions with pre and post assessment findings of case 1.

Case description	Pre-training assessment	Intensive Physiotherapy Interventions	Post-training assessment
<ul style="list-style-type: none"> <li>• A 60-year male farmer</li> <li>• Sudden onset, with inability to move right extremities</li> <li>• Known case of hypertension</li> <li>• Diagnosis: left thalamo-ganglionic intracranial hemorrhage</li> <li>• Routine and basic Physiotherapy treatment was provided in acute care</li> <li>• At one week he was medically/surgically stable</li> <li>• He was shifted to IPTU for IPI of 3 weeks.</li> <li>• Major complaints: Inability to walk, inability to use his dominant right hand for eating/drinking independently, wheelchair bound.</li> <li>• He required maximum assistance for his ADL.</li> <li>• Secondary problem: Traumatic knee flexion deformity in chronic stage.</li> </ul>	<ul style="list-style-type: none"> <li>• FMA: UE: motor- 39/66, LE: motor- 10/34 (right)</li> <li>• Barthel Index: 7/20</li> <li>• Drinking task: Unable (with right hand)</li> <li>• Sit to stand and standing: Unable</li> <li>• TUG: Unable</li> <li>• Sensation: Absent or impaired (superficial and proprioception) at UE and LE</li> <li>• MMT: varied between 0 and 4 (right).</li> </ul>	<ul style="list-style-type: none"> <li>• <b>AOE:</b> It was first line of physiotherapy treatment. Protocol adopted was based on the study by Adhikari et al.,(4). Parameters: 3 min of AO + 2 min of E*5 repetitions (reps) per component, total 30 min/session/day*6 days/week</li> <li>• <b>Modified CIMT:</b> The modified CIMT primed with AOE on second week, The modified CIMT of 45 min for was administered based on protocol of a trial by Winstein et al., (9)</li> <li>• <b>BWSTT:</b> The protocol was adopted from the study by Ada et al.,(10). Training was for 15 minutes/session*2 sessions/day</li> <li>• <b>IOT:</b> Dynamic quads, bridging, alternating isometrics of weak muscles of UE and LE, 5 reps* 5 sets / session for 2 weeks</li> <li>• <b>Body activities with controlled and corrected gait training:</b> sitting to standing, standing, wall squats, weight shifting, side walking, walking against wall, stairs climbing up and down, 40 min per day (10 min each) for 2 weeks.</li> <li>• <b>Caregiver supported training/patient’s self-practice:</b> As per physiotherapists’ prescription.</li> </ul>	<ul style="list-style-type: none"> <li>• FMA: UE-motor: 52/66, LE-motor: 21/34 (right)</li> <li>• Barthel Index: 15/20,</li> <li>• Drinking task: Able to perform using right hand</li> <li>• Sit to stand: Able independently</li> <li>• Standing: Able, duration: 10 sec</li> <li>• TUG: Able, Time: 62 seconds</li> <li>• Sensation (superficial and proprioception): Absent changed to present but impaired, and impaired changed to normal improved</li> <li>• Muscle strength (out of 5): 0 and 1 improved to 2, 2 improved to 3, 3 and 4 improved to 5 (right).</li> </ul>

AOE: Action observation execution, CIMT: Constraint Induced Movement Therapy, BWSTT: Body weighted supported treadmill training, IOT: Impairment oriented training, FMA UE and LE: Fugl Meyer assessment scale for upper extremity and lower extremity, TUG: Timed Up and Go test, FIM: Functional Independent Measures, ADL: Activities of daily living, IPTU: Intensive Physiotherapy Treatment Unit, IPI: Intensive Physiotherapy Interventions

therapist collaboration[4] based on assessment findings. It was scheduled in such a way that each domain (motor, sensory, cognitive, activity, functional and locomotion) received TAI at least one session every day for six days/week. In between TAI sessions, patient or caregiver was trained to carry out caregiver-assisted practice (CAP) or self-practice (SP) as prescribed by physiotherapists. The patients/caregiver was asked to record their practice diary. The IPI schedule has been described in **Figure 1**. The medical and surgical consultations were provided whenever required which gave an additional advantage of multidisciplinary approach in patient care. The nurses who were trained for

therapeutic care provided education and counseling sessions to motivate patients for practice and monitor practice sessions in addition to routine nursing care. One physiotherapist assessed the patient before and after the intervention. Two other physiotherapists completed the treatment. Patients' information, physiotherapy interventions and pre-post assessment findings have been presented in **Tables 1, 2 and 3**.

**DISCUSSION:**

The IPI administered in an EE in sub-acute stroke yielded good recovery in relatively short duration. All patients completed three weeks of intensive physiotherapy at IPTU. None of the patient

*Table 2: Case description and interventions with pre and post assessment findings of case 2.*

Case description	Pre-training assessment	Intensive Physiotherapy Interventions	Post-training assessment
<ul style="list-style-type: none"> <li>• A 60-year female</li> <li>• Sudden onset with inability to move right extremities</li> <li>• Known case of hypertension, no other relevant medical history</li> <li>• Diagnosis: Left thalamo-ganglionic hematoma with extension to lateral ventricle</li> <li>• Routine and basic Physiotherapy treatment was provided in acute care</li> <li>• At one week she was medically/ surgically stable</li> <li>• She was shifted to IPTU for IPI of 3 weeks.</li> <li>• Major complaints: Wheel-chair bounded, unable to do her ADL.</li> <li>• She was on Foley's catheter.</li> <li>• No secondary problem reported</li> </ul>	<ul style="list-style-type: none"> <li>• FMA: UE-motor: 18/66, LE-motor: 4/34 (right)</li> <li>• FIM: 48/126:</li> <li>• Tone: Bulk muscles of UE- flaccid (right)</li> <li>• TUG: Unable to perform</li> <li>• Drinking task: Unable to reach and grasp using right UE</li> <li>• Consciousness: Glasgow Coma Scale: 15/15,</li> <li>• Cranial nerve: intact</li> <li>• Sensation: diminished over right half of the body.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Modified CIMT:</b>It was the first line of physiotherapy treatment. The modified CIMT of 45 min was administered based on the protocol of a trial by Winstein et al., (9). Task: drinking (components: reaching, grasping, transporting), Adapting shaping, distributed practice, rest minimum, Duration: 30 min*twice a day*6days per week for 3 weeks, Progression: task complexity</li> <li>• <b>IOT:</b> Finger mass flexion - extension training, shortened held resisted contraction, active-assisted/active range of motion exercise, weight shifting, bridging, tapping induced reeducation, tone facilitation, 5-10 reps*2 sets*6days/week for 3 weeks.</li> <li>• <b>PNF:</b> Overflow to muscles at 0 and 1 out of 5, mass movement pattern, 5-10 reps*2 sets*6days/week for 3 weeks</li> <li>• <b>BWSTT:</b> Sitting to standing, standing, weight shifting, controlled and corrected walking, 5-10% weight bear on progression, 0.5 km/hr*1min and 30 sec rest*5reps.The protocol was adopted from the study by Brown et al, and Ada et al,(10).</li> <li>• <b>Forced used of the affected LE:</b> Step forward and backward, stepping up and down in stairs, 15 min/day*6 days for 3 weeks. The concept was adopted from of a trial by Winstein et al, (9).</li> <li>• <b>Functional training:</b> Controlled and corrected walking, walking along the wall, climbing up and down the stairs, independent walking, 30 min*2 sessions, 10 min each component, for 3 weeks</li> <li>• <b>Caregiver supported training/patient's self-practice:</b> As per physiotherapists' prescription.</li> </ul>	<ul style="list-style-type: none"> <li>• FMA: UE-motor: 42/66, LE-motor: 11/34 (right)</li> <li>• FIM: 80/126,</li> <li>• Tone: normal (muscles of right extremities)</li> <li>• TUG: Able (but &gt; 30 sec time with walker)</li> <li>• Drinking task: Able to reach, grasp and drink independently using right UE.</li> </ul>

AOE: Action observation execution, CIMT: Constraint Induced Movement Therapy, BWSTT: Body weighted supported treadmill training, IOT: Impairment oriented training, FMA UE and LE: Fugl Meyer assessment scale for upper extremity and lower extremity, TUG: Timed Up and Go test, FIM: Functional Independent Measures, ADL: Activities of daily living, IPTU: Intensive Physiotherapy Treatment Unit, IPI: Intensive Physiotherapy Interventions, PNF: Proprioceptive Neuromuscular Facilitation

demonstrated any adverse effects. The intervention's effect that all patients demonstrated was visible and measurable on the outcome measures.

which is a golden period of stroke recovery.[4] The marked improvement achieved indicated good and fast recovery within three weeks of the treatment. Structured, evidence-based interventions

All cases were treated in sub-acute stage

Table 3: Case description and interventions with pre and post assessment findings of case 3.

Case description	Pre-training assessment	Intensive Physiotherapy Interventions	Post-training assessment
<ul style="list-style-type: none"> <li>• A 40-year male</li> <li>• Presented with history of trauma</li> <li>• No relevant past medical and surgical history.</li> <li>• Diagnosis: Right-sided intra-cranial hematoma over frontal and parietal lobe.</li> <li>• Routine and basic Physiotherapy treatment was provided in acute care.</li> <li>• At one week he was medically/ surgically stable.</li> <li>• He was shifted to IPTU for IPI of 3 weeks.</li> <li>• Major complaints: Wheelchair bound, UE: relatively weak but it can be moved</li> <li>• Arm sling was placed on affected arm to prevent shoulder subluxation.</li> </ul>	<ul style="list-style-type: none"> <li>• FMA (left): UE-motor: 56/66, LE-motor: 6/34</li> <li>• FMA (left): UE: light touch- 2/4 and position- 8/12, LE: light touch: 0/4 and position: 1/8</li> <li>• FMA (left): UE total – 111/126, LE total – 57/86</li> <li>• BBS: 12/56,</li> <li>• FIM: 73/126</li> <li>• TUG: Unable to perform, wheelchair bound</li> <li>• Tone (left): Major muscles of UE- Normal, major muscles of LE- Flaccid</li> <li>• No any cognitive, perceptual problem or cranial nerve abnormality.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>IOT integrated with controlled functional training:</b> It was first line of physiotherapy treatment. Intensive supervised physiotherapy sessions lasting for 60-90 min*two sessions with an interval of at least 3 hours between sessions for 6 days/week.</li> <li>• <b>PNF:</b> Overflow principle for knee flexors and ankle dorsiflexors through hip flexors, assisted diagonal pattern movement, quick tapping and stroking of muscles of left LE for 1 week. On progression: Rhythmic initiation and alternating isometrics exercises at pelvis during bridging and kneel standing</li> <li>• <b>Sensory re-education:</b> Tactile localization and position sense training in left UE and LE using different textured-objects, initially with vision and later with visual occlusion.</li> <li>• <b>Forced used therapy with functional training of left limb:</b> Forced used therapy of affected limb followed by treadmill walking, elliptical cycling with minimal or without support.</li> <li>• <b>Sensory re-education incorporated with strengthening exercises:</b> Supported bridging, concentric hold of shoulder against gravity in different directions, scapular stabilizers strengthening. On progression, bridging on foam, pelvic lift with squeeze ball below knees, wall squat, back extensors isometric exercise with tactile feedback, quadruped limb loading exercises, dynamic quads, standing on foam with feet apart with and without eyes closed, mat exercises for various activities</li> <li>• <b>Caregiver supported training/patient's self-practice:</b> As per physiotherapists' prescription.</li> </ul>	<ul style="list-style-type: none"> <li>• FMA (left): UE-motor: 66/66, LE-motor: 25/34</li> <li>• FMA (left): UE light touch: 4/4 and position: 12/12, LE light touch: 2/4 and position: 7/8</li> <li>• FMA (left): UE total – 124/126, LE total – 68/86</li> <li>• BBS: 48/56,</li> <li>• FIM: 108/126</li> <li>• TUG: Able to perform, Time: 40 sec</li> <li>• Tone (left): Major muscles of UE and LE - Normal</li> </ul>

AOE: Action observation execution, IOT: Impairment oriented training, FMA UE and LE: Fugl Meyer assessment scale for upper extremity and lower extremity, TUG: Timed Up and Go test, ADL: Activities of daily living, IPTU: Intensive Physiotherapy Treatment Unit, IPI: Intensive Physiotherapy Interventions, PNF: Proprioceptive Neuromuscular Facilitation, MAS: Modified Ashworth Scale, BBS: Berg Balance Scale



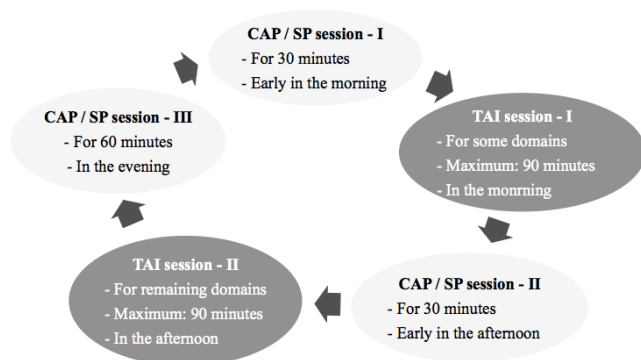


Figure 1. Intensive Physiotherapy Interventions of each day. CAP: Caregiver- assisted practice, SP: Self practice, TAI: Therapist-administered interventions.

were applied to all the cases with the necessary modification based on a study by Adhikari et al.[4] Patient-therapist collaboration as described by Adhikari et al., in their study [4] further supported for intervention modification to make interventions feasible and appropriate in Nepalese cultural context and background.

All cases demonstrated marked improvement both in impairment and activity level as shown by various outcome measures, which indicated that, the interventions were able to address all the domains. It was not possible to administer TAI as per the protocol for all the domains if the patients were not admitted in the institution. This is because the intensive interventions required longer time with rest time in between for each impairment and activity limitations. Additionally, the interval between the sessions has to be enough ( $\geq 2$  hours) to avoid fatigue and to allow enough time for consolidation of the learned task. The load, duration and rest period were managed in such a way that the interventions were neither too less (enough to engage the patients and induce neuroplasticity) nor too more (enough rest period in between to avoid fatigue) based on the principles of exercise dependent neuroplasticity.[8] Furthermore, the EE set in the IPTU engaged patients to practice the prescribed exercises. This finding was consistent with the findings from Tijssen et al., who demonstrated improvement in activity level when the environment was well enriched for therapeutic goals.[6]The EE might have helped to transfer the skills from one activity to another, because, as per Kleim et al., there will be transference of skills when similar activities are matched while training.[8] Therefore, matching TAI with that of CAP/SP was one of the important factors to enhance transference and avoid interference, which was achieved while

treating patients admitting in IPTU in the present study. The total therapeutic time (TAI and CAP/SP) was  $\geq 5$  hours per day, which was much more than the time engaged when a patient is treated in an outpatient basis or at home. The effect of increased engaged-time supported recovery as demonstrated in a study by Tijssen et al.[6] Thus, administration of evidence-based protocol, long duration of engagement in exercises, matching TAI with CAP/SP, enriched environment and multidisciplinary care, all supported to yield better and faster recovery in present case study and highlighted the need and of institution based IPI in sub-acute stroke.

All participants and their caregivers got motivated due to the improvement seen over time. They also actively participated as the environment encouraged them to carry out prescribed exercises. The timely support from the nurses, frequent consultation from the surgeon/physician within the unit further supported to result better outcome in short duration.

## CONCLUSION:

All cases demonstrated marked improvement both in impairment and activity levels, which indicated good and speedy recovery with IPI administered in an EE. The interventions applied, and the principles adapted were based on established evidence, and therefore findings of this study may support for its feasibility and applicability. However, large-scale studies are warranted.

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