February 1, 2026

STUDY PROTOCOL

Study Title / Objective:

To investigate the effects of Kinesiology Taping applied over the diaphragm muscle on pulmonary function, postural balance, functional capacity, and quality of life in stroke patients.

Methods

Study Design and Participants:

This study is conducted with 30 patients diagnosed with hemiplegia who are actively undergoing rehabilitation and meet the inclusion criteria. Eligible participants are informed in detail about the study protocol, and written informed consent is obtained prior to enrollment.

Inclusion Criteria:

- Radiologically confirmed diagnosis of cerebrovascular accident (stroke)
- Medically stable condition
- Age $\geq$ 18 years
- Literate
- Unilateral hemiplegia
- First-ever stroke episode
- Mini-Mental State Examination (MMSE) score > 24
- No documented history of chronic cardiovascular and/or pulmonary disease
- Absence of facial palsy
- Lower extremity Brunnstrom motor recovery stage of ≥ 3

Exclusion Criteria:

- Enteral nutrition via Percutaneous Endoscopic Gastrostomy (PEG)
- History of surgical intervention within the preceding 6 months
- Pregnancy
- Presence of skin lesions, irritation, or compromised skin integrity in the application area
- Presence or history of deep vein thrombosis
- Confirmed diagnosis of heart failure
- Uncontrolled hypertension and/or severe cardiac disease

- History of epileptic seizures

Participants meeting all inclusion criteria without any exclusion factors who signed the informed consent form were enrolled in the intervention program.

Outcome Measures and Assessment Protocol

Participants are assessed at baseline (pre-intervention) and at the end of the 8-week intervention period (post-intervention) using the following outcome measures:

- **Demographic and Clinical Data Form:** Structured questionnaire assessing baseline demographic and clinical characteristics.
- **Pulmonary Function Tests (PFT):** Spirometric evaluation of lung volumes and flow rates (FVC, FEV_1, FEV_1/FVC, PEF,FEF_{25-75}).
- **Respiratory Muscle Strength:** Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP).
- **Functional Exercise Capacity and Mobility:** 2-Minute Walk Test (2MWT) and 5-Times Sit-to-Stand (5XSTS) Test.
- **Postural Balance and Stability:** Biodex Balance System (BBS) evaluating stability indices under static and dynamic conditions.
- **Health-Related Quality of Life:** Stroke-Specific Quality of Life Scale (SSQOL / SS-QOL).
- **Functional Independence**: Modified Barthel Index
- **Fatigue Severity Scale (FSS)**
- **Cognitive Status**: Mini-Mental State Examination (MMSE)

The intervention program was designed as follows:

Control Group:

- Initially, a single educational session on effective breathing techniques was provided.
- Subsequently, general physical therapy sessions were administered twice weekly for 8 weeks.
- Following each general physical therapy session, sham Kinesio Tex Taping was applied to the anterior chest wall, followed by breathing exercises.
- Patients were instructed to perform the breathing exercises twice daily (morning and evening), 5 days per week, while the tape remained in place.
- Home-based breathing exercises were tracked using daily compliance log sheets distributed to the patients and reviewed at each clinic visit.
- The tape was replaced every 3 days.

Study / Experimental Group:

- Initially, a single educational session on effective breathing techniques was provided, consisting of:

    - Inhaling through the nose for 2 seconds and exhaling through the mouth for 4 seconds (pursed-lip breathing).
    - Diaphragmatic breathing instruction, asking the patient to expand the abdomen during inspiration.
- Subsequently, general physical therapy sessions were administered twice weekly for 8 weeks.
- Following each general physical therapy session, Kinesio Tex Taping was applied over the diaphragm muscle, followed by breathing exercises.
- Patients were instructed to perform the breathing exercises twice daily (morning and evening), 5 days per week, while the tape was in place.
- Home-based breathing exercises were monitored via daily compliance logs and checked at each visit.
- The tape was replaced every 3 days.

Kinesiology Taping Application Protocol:

- **Control Group:** Tension-free sham taping was applied over the anterior chest wall (sternum).
- **Study Group:** With the patient in an erect standing position, the tape length was measured starting from the xiphoid process, tracing the lowest rib, crossing the T12 vertebra posteriorly toward the contralateral side, leaving a 5-cm gap from the last rib. The prepared tape was adhered starting from its midpoint over the xiphoid process with 100% tension. Following initial adherence, the patient was instructed to perform maximal inspiration; the left end of the tape was then applied along the level of the lowest rib extending to the T12 vertebra. The identical procedure was repeated for the contralateral end. To avoid restricting trunk rotational movements, an approximate 5-cm distance was maintained between the two ends, ensuring they did not overlap or make contact.

General Physical Therapy Session:

- **20 minutes of exercise therapy:**
    - Stretching exercises for all four extremities
    - Non-resisted (active) strengthening exercises for all four extremities
    - Gait training on parallel bars, treadmill walking, and stair climbing
    - Balance training, including tandem walking and standing with eyes closed
- **20 minutes of electrotherapy:**
    - Neuromuscular Electrical Stimulation (NMES) applied to the lower extremities

Breathing Exercises Protocol:

- **Diaphragmatic Breathing (10 repetitions):** With the patient placed in a comfortable, back-supported sitting position, the therapist positions one hand on the patient's chest and the other on the abdomen. The patient is instructed to inhale calmly through the nose while expanding the abdomen and to exhale gently through the mouth. At the end of expiration, light manual pressure is applied over the abdominal region to enhance sensory awareness. The exercise is performed as 5 repetitions followed by a 5-minute rest

interval, completed with an additional 5 repetitions. This technique may be combined with pursed-lip breathing.

- **Thoracic Expansion Exercises (10 repetitions):** Applied over the lateral costal area of the hemiplegic side targeting thoracic expansion. At the end of expiration, manual pressure is applied over the ribs to heighten sensory awareness and facilitate deep inspiration. Following 5 repetitions, a 5-minute rest break is given before executing the remaining 5 repetitions. It can be combined with pursed-lip breathing.
- **Sustained Maximal Inspiration (Inspiratory Hold - 5 repetitions):** A maneuver aimed at facilitating airflow into poorly ventilated lung regions. Patients are instructed to take a deep inspiration, hold their breath at full lung capacity for 2–3 seconds without performing a Valsalva maneuver, and then exhale in a relaxed manner. Following 3 initial repetitions, a 3-minute rest interval is provided prior to executing the remaining 2 repetitions. This technique can also be integrated with pursed-lip breathing.

Monitoring and Follow-up:

- Peripheral oxygen saturation (SpO_2) was continuously monitored using a pulse oximeter throughout all breathing exercise sessions.
- All baseline outcome measurements and clinical assessments were repeated at the conclusion of the 8-week intervention period.