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Effectiveness of action observation therapy in school going student suffering from trapezitis due to heavy school bags. Experimental study

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Abstract
Background: Heavy school bags commonly contribute to neck and upper-back pain in school-going children by causing strain and inflammation of the trapezius muscle. Action Observation Therapy (AOT), which involves observing and imitating movements, has shown benefits in improving motor control and reducing pain. This study aims to evaluate the effectiveness of AOT in managing trapezitis caused by heavy school bags in school-aged students.
Methods: A total of 53 school-going students aged 10–16 years with trapezitis due to heavy school bags were randomly allocated into two groups. Group A (experimental) received Action Observation Therapy along with conventional physiotherapy, while Group B (control) received conventional physiotherapy alone. The intervention was administered for 2 weeks, with two 30-minute sessions per week.
Results: A total of 53 participants were included, with 26 in Group A and 27 in Group B. Within-group analysis showed that both groups had statistically significant improvements in pain intensity (NPRS) and neck-related disability (NDI) from pre-test to post-test ($p < 0.001$). Group A demonstrated a marked reduction in NPRS (5.6 ± 0.7 to 3.8 ± 0.7) and NDI scores (19.9 ± 3.4 to 13.3 ± 2.7). Group B also showed significant improvements, with NPRS reducing from 5.9 ± 0.9 to 4.7 ± 0.9 and NDI from 19.8 ± 3.5 to 16.1 ± 1.9. Between-group comparison revealed significantly greater improvements in Group A compared to Group B. The percentage reduction in both NPRS and NDI was higher in Group A, indicating superior effectiveness in reducing pain and improving functional disability.
Conclusion: Action Observation Therapy is a safe and effective intervention for reducing pain and neck-related disability in school-going children with trapezitis due to heavy school bags. When combined with conventional physiotherapy, AOT demonstrates superior outcomes and supports its use in pediatric musculoskeletal rehabilitation.

Keywords: Action observation therapy, trapezitis, school-going students, heavy school bags

Introduction

Musculoskeletal neck and shoulder pain has become increasingly common among school-going children due to prolonged sitting, poor posture, electronic device use, and carrying heavy school bags. Excessive and sustained loading places continuous stress on the cervical spine and shoulder girdle, particularly affecting the upper trapezius muscle, which serves as a key postural stabilizer. Overuse and prolonged activation of this muscle can lead to trapezitis, resulting in pain, stiffness, and restricted neck movement. As children's musculoskeletal systems are still developing, they are less capable of tolerating excessive mechanical stress. This growing problem highlights the need for effective preventive and therapeutic interventions to reduce school-related neck and shoulder pain [1].

A descriptive survey among school-going students aged 10–17 years in Islamabad revealed a strong association between heavy backpack loads and musculoskeletal pain. Students carrying backpacks exceeding 10% of their body weight showed a significantly higher prevalence of neck (67.2%) and shoulder pain (31.3%). Excessive load carriage leads to altered biomechanics, muscle fatigue, and sustained stress on postural muscles such as the upper trapezius. Prolonged exposure to these stresses during a critical growth period increases the risk of musculoskeletal discomfort. These findings highlight the need for awareness, ergonomic education, and adherence to recommended backpack weight limits to prevent long-term neck and shoulder problems [2].

Another study conducted in Bangalore, India, highlighted the musculoskeletal risks associated with excessive backpack loads among school-going children. The study found that students carried backpacks averaging 13.53% of their body weight, exceeding recommended safety limits. This excessive load was significantly associated with postural deviations such as forward head posture, rounded shoulders, and altered spinal alignment, increasing stress on the neck and shoulder muscles. A higher prevalence of pain and discomfort was observed among female students compared to males, possibly due to differences in muscle strength and load tolerance. These findings emphasize the need for ergonomic interventions and gender-specific preventive strategies to promote musculoskeletal health in school-aged children [3].

These findings are supported by narrative reviews indicating that many students carry backpacks exceeding recommended weight limits, which are strongly associated with chronic neck, shoulder, and back pain. Prolonged exposure to heavy loads leads to postural deviations such as forward head posture and rounded shoulders, increasing musculoskeletal stress. If unaddressed, these changes may persist into adulthood, resulting in long-term pain and functional impairment [4].

The cumulative evidence indicates that backpack weight is a multifactorial risk factor for musculoskeletal problems in schoolchildren, interacting with load duration, backpack design, posture, and individual physical characteristics. Excessive and prolonged backpack use contributes to pain, altered biomechanics, and postural adaptations in the developing musculoskeletal system. Therefore, educational policies promoting lighter loads, ergonomic awareness, and supportive measures such as lockers and digital resources are essential to reduce musculoskeletal risk and protect long-term spinal health [5].

Prolonged forward head posture places excessive and continuous demands on the cervical and upper thoracic muscles, particularly the upper trapezius and levator scapulae, leading to early fatigue, reduced endurance, and pain. Over time, sustained loading and compromised circulation promote inflammation and trigger point formation, contributing to the development of trapezitis. These postural stresses are further intensified by daily backpack carriage, significantly increasing the risk of persistent neck and shoulder pain in school-aged children. Improper backpack use, such as asymmetrical carrying or poorly adjusted straps, causes uneven muscle activation and altered spinal alignment, placing disproportionate strain on the trapezius. Emerging evidence highlights that direct muscular overload, rather than generalized spinal discomfort alone, plays a key role in trapezitis, emphasizing the need for targeted postural and muscular interventions [6].

Trapezitis is a musculoskeletal condition primarily affecting the upper fibers of the trapezius muscle and is characterized by persistent neck and shoulder pain. The condition is commonly associated with muscle tightness, stiffness, and difficulty performing routine movements such as head rotation and prolonged postures. A key feature is localized tenderness and trigger point formation in the upper trapezius, often referring pain to the head, upper back, or shoulders. Reduced cervical range of motion and functional limitations may further impair daily activities and quality of life [7].

Conventional management of trapezitis focuses on relieving symptoms by addressing peripheral tissue dysfunction and postural stress. Core strategies include postural education, ergonomic modifications such as reducing backpack weight and promoting balanced carrying, and therapeutic exercises to improve muscle flexibility, strength, and endurance. Stretching tight muscles and strengthening postural stabilizers help restore normal alignment and reduce mechanical strain on the trapezius. Manual therapy techniques, including soft-tissue mobilization and massage, are used to reduce muscle tightness and trigger point sensitivity. Pain-relieving modalities such as ultrasound and TENS provide symptomatic relief and support active rehabilitation. However, as these approaches primarily target peripheral factors, complementary therapies like Action Observation Therapy may be needed to address central mechanisms and maladaptive movement patterns [8].

Recent advances in neuroscience have shown that the brain can adapt through neuroplasticity, reorganizing itself after injury, disuse, or pain. Action Observation Therapy (AOT) uses this principle by engaging the Mirror Neuron System, which activates the same brain areas when observing and performing movements. AOT involves an observation phase, where participants watch specific movements, followed by an execution phase, where they perform the movements themselves. This process reinforces neural pathways, promotes proper cortical reorganization, and improves motor learning. By retraining the brain, AOT supports recovery and functional improvement in musculoskeletal conditions [9].

A 2023 randomized controlled trial examined the immediate effects of a single Action Observation Therapy (AOT) session in adults with chronic neck pain. Participants who observed therapeutic neck movements showed reduced pain, suggesting that action observation engages central mechanisms of pain modulation, attention, and expectancy. While some pain reduction occurred in the control group, the results support AOT as a safe, non-invasive intervention that can influence motor control and provide short-term relief. These findings highlight its potential for repeated use and long-term benefits in musculoskeletal conditions like trapezitis [10].

A study combining motor imagery and action observation of neck exercises showed significant immediate pain reduction in individuals with chronic neck pain. Participants not only reported less pain but also demonstrated improved pain pressure thresholds, indicating reduced local sensitivity. These findings suggest that mental practice strategies can modulate pain centrally and improve physiological responses without physically stressing the cervical structures [11].

Carrying heavy school bags has become a major health concern, contributing to trapezitis in children, which causes neck and shoulder pain, muscle tightness, and reduced range of motion. Prolonged mechanical strain and poor posture, such as forward head posture and rounded shoulders, increase musculoskeletal stress, with girls often more affected than boys. Conventional treatments are often impractical in school settings, creating a need for safe, accessible, and engaging therapies. Action Observation Therapy (AOT) offers a promising solution by activating the brain’s motor networks through observing and performing goal-directed movements, improving motor learning, muscle activation, and pain modulation without physical strain. Evidence from adult studies and systematic reviews suggests that mental practice interventions, including AOT, can reduce pain, improve function, and enhance quality of life, supporting its potential application in school-aged children. Disability and pain outcomes can be effectively measured using tools like the Neck Disability Index (NDI) and Numeric Pain Rating Scale (NPRS), ensuring reliable assessment of intervention benefits.

Need for the study

- The increasing weight of school bags has become a growing concern particularly among school going children this burden often leads to musculoskeletal disorders, including Trapezitis
- Overall wellbeing, the growing prevalence of condition there is limited research on non-invasive school
- friendly Therapeutic intervention for managing and preventing trapezitis in this population
- Treatment methods like rest medication may not always be feasible or suitable for children during school hours. physiotherapy Treatment modalities like cry therapy, ultrasound Therapy, TENS Taping, Dry Needling& MFR.
- Action observation Therapy done on chronic neck pain & Adhesive capsulitis patients so using giving relieve

trapezitis even after literate survey it was found that neuro- technique use to released trapezitis pain.

- Need to child appropriate Engaging and school compatible therapist that can alleviate musculoskeletal pain understand the impact of (AOT) on muscle function, Pain Perception, Posture in children provide evidence-based recommendation to Educator, Parents, healthcare professionals for Managing Posture related issue in school setting.
- This study aims to fill the Existing research gap by evaluating the Efficacy of Action observation therapy as a non-invasive and Accessible intervention for Trapezitis in students caused by heavy school bags.

Aim

To check the Effectiveness of Action observation Therapy in school going student suffering from Trapezitis due to Heavy schoolbags.

Methodolgy & materials

Method

The data for the study will be collected from a school in Kopargaon. An experimental study design will be used, and the sample population will consist of school-going students aged between 10 and 16 years. A total sample size of 53 participants will be calculated using OpenEpi software (Version _), based on the formula $n = [DEFF \times Np(1-p)] / [(d^2 / Z^2_{1-\alpha/2}) (N-1) + p(1-p)]$. Participants will be selected using a simple random sampling technique through the lottery method. The total duration of the study will be six months.

Materials

The materials required for the study included a chair, Table, Mobile Exercise tool: light TheraBand, Towel NDI &NPRS Scale paper, Weight machine These materials were utilized to ensure participant comfort and hygiene throughout the study.

Selection criteria

Inclusion Criteria

1. School going student of age group 10 - 16 year studying in 8^{th} -10^{th} standard students
2. student carrying heavy bags (more than 10% of body weight
3. Participant symptoms are pain in shoulder & neck presence tenderness in upper trapezium muscle & limited cervical range of motion.
4. History of carrying school bags heavier than 10% there of body weight.

Exclusion Criteria

1. School going students of more than age group 16year & less than 10 years
2. Participant with neurological disorder or cognitive
3. Participant with any inability to follow video- based instructions, visual impairments, attention disorder.

Outcome mesures

1. Numerical pain rating scale (NPRS)

The NPRS is a unidimensional tool measuring pain intensity on a 10-point scale (0 = no pain, 10 = worst imaginable pain). It is simple, quick (<1 min), and usable in self-report, interviews, or telephone formats across languages and cultures. Preferred over the Visual Analogue Scale VAS), it demonstrates high test–retest reliability ($r \approx 0.95$) and strong construct validity ($r = 0.86$–0.95 vs VAS). It is sensitive to small changes in pain but may not capture the multidimensional complexity of chronic pain experiences.

Neck disability index (NDI)

The Neck Disability Index (NDI) is a standardized, self-reported questionnaire developed by Vernon and Moir to assess neck-related functional disability in individuals with neck pain. It consists of 10 items covering daily activities such as pain intensity, personal care, lifting, reading, headaches, concentration, work, driving, sleeping, and recreation. Each item is scored on a 6-point Likert scale (0–5), giving a total score out of 50, where higher scores indicate greater disability. Scores are categorized from no disability (0–4) to complete disability (35–50). The NDI is widely used in clinical practice and research due to its high reliability, validity, and sensitivity to change. It is especially useful for evaluating treatment outcomes in neck conditions such as trapezitis.

Intervention

The intervention was carried out for 4 weeks, with 4 sessions per week. Each session lasted for 15 minutes. Participants in both groups received treatment under the supervision of a physiotherapist to ensure safety and correct performance.

Group Allocation

A total of 53 participants who met the inclusion criteria were enrolled in the study. The participants were divided into two groups:

1. **Group A:** Action Observation Therapy (AOT) Group: 27 participants
2. **Group B:** Conventional Exercise Group: 26 participants

Both groups received their respective interventions for a duration of 4 weeks.

Intervention protocol

The intervention was carried out for 4 weeks, with 4 sessions per week. Each session lasted for 15 minutes. Participants in both groups received treatment under the supervision of a physiotherapist to ensure safety and correct performance

Group A – Action Observation Therapy (AOT)

Action Observation Therapy was administered to participants in the experimental group with the aim of improving motor performance, reducing pain, and enhancing postural control through activation of the mirror neuron system. This therapeutic approach involves observing goal-directed movements, which facilitates motor learning and cortical reorganization.

Starting position & setup

Participants were instructed to sit comfortably on a chair with back support, maintaining an upright posture. The feet were placed flat on the floor, and the head and neck were kept in a neutral position. A laptop screen was positioned approximately two meters in front of the participant at eye level to ensure clear visibility and to minimize neck strain. The environment was kept quiet and free from distractions.

Selection of Movements

Four common categories of neck, shoulder, and upper back movements were selected for the Action Observation Therapy protocol based on relevant literature and clinical expertise. These movements were chosen as they are frequently limited in individuals with neck pain, trapezitis, and postural dysfunction.

Procedure

Participants were instructed to carefully watch the video clips showing a person performing slow, controlled, and functional movements involving the neck, shoulders, and upper back. The demonstrated movements included:

- Scapular retraction exercises performed with correct upright posture
- Neck and shoulder mobility exercises, such as chin tucks and shoulder rolls
- Isometric activation exercises targeting the trapezius muscles, with particular emphasis on the lower trapezius

Participants were instructed not to physically perform the movements during the observation phase. Instead, they were encouraged to focus their attention on the quality of movement, posture, range of motion, and muscle engagement, and to mentally simulate performing the exercises.

Fig 1: Trapezius stretching with AOT

Fig 2: Isometric activation exercise with AOT

Session structure

The total duration of each Action Observation Therapy session was 15 minutes, structured as follows:

- Five minutes of active observation, during which participants watched exercise clips (approximately two minutes per exercise)
- Three minutes of rest, during which a completely black screen was displayed to avoid visual distraction and allow cognitive processing
- This sequence was followed by a repetition of the exercise observation phase for approximately four minutes

Instructions to Participants

- Maintain a relaxed and upright sitting posture throughout the session
- Focus attention on the movement being performed in the video
- Avoid any physical movement during the observation phase
- Perform mental rehearsal of the observed movements

Action Observation Therapy is believed to activate motor-related brain areas involved in movement execution, even in the absence of physical movement. By observing meaningful and functional tasks, participants may experience improvements in motor planning, postural control, and pain reduction. This approach is particularly beneficial for individuals who are unable to perform exercises actively due to pain or stiffness.

Group B – Conventional Exercise Program

Participants allocated to Group B received a conventional physiotherapy exercise program commonly used for the management of neck pain and trapezitis. The exercise program focused on pain reduction, muscle relaxation, improvement of flexibility, correction of posture, and strengthening of the neck and upper back muscles.

The conventional exercise protocol included the following components:

Trigger point release and myofascial release techniques- were applied to the upper trapezius and the surrounding cervical and shoulder musculature with the aim of reducing muscle tension, pain, and soft-tissue restrictions. Trigger point release involved the identification of localized hyperirritable nodules within taut bands of the upper trapezius muscle. Sustained manual pressure was applied directly over the trigger points using the therapist's thumb or fingers until a reduction in tenderness and muscle tightness was perceived or until the participant reported a decrease in discomfort. Myofascial release techniques were performed by applying gentle, sustained pressure and slow stretching to the myofascial tissues surrounding the upper trapezius region. The therapist used controlled hand placements to engage the fascial restrictions and maintained the stretch for an adequate duration to allow tissue relaxation. These techniques aimed to improve local blood circulation, decrease fascial adhesions, and restore normal muscle length and flexibility. applied to the upper trapezius and surrounding musculature to reduce muscle tension and pain

Upper trapezius stretching-

Upper trapezius stretching was included in the conventional exercise program to reduce muscle tightness, relieve neck and shoulder pain, and improve cervical range of motion. Tightness of the upper trapezius muscle is commonly associated with neck pain, trapezitis, and poor posture; therefore, stretching this muscle helps in restoring normal muscle length and improving functional neck movements.

Starting Position

The participant was instructed to sit comfortably on a chair with the back supported and feet placed flat on the floor. The spine was maintained in an upright position, and both shoulders were kept relaxed and in a neutral position.

Procedure

1. The participant was asked to gently tilt the head sideways, bringing the ear toward the shoulder on the opposite side of the muscle being stretched.
2. The shoulder on the side being stretched was kept depressed to ensure effective isolation of the upper trapezius muscle.
3. To enhance the stretch, gentle overpressure was applied using the hand placed over the side of the head, ensuring that the movement remained slow and within a pain-free range.
4. Care was taken to avoid neck rotation or forward bending during the stretch.

Dosage

The stretch was held for 15–30 seconds and then slowly released. It was repeated for the prescribed number of repetitions with adequate rest between each repetition. Upper trapezius stretching helps in decreasing muscle tension, improving blood circulation, and reducing pain. Regular stretching of this muscle contributes to improved cervical mobility, correction of postural imbalances, and enhanced functional performance in daily activities.

Fig 3: Upper trapezius stretching

3. Levator scapulae stretching

Levator scapulae stretching was incorporated into the conventional exercise program to reduce muscle tightness, alleviate neck and shoulder pain, and improve cervical mobility. Tightness of the levator scapulae muscle is commonly associated with neck pain and postural dysfunction; therefore, stretching this muscle helps in restoring normal muscle length and function.

Starting Position

The participant was instructed to sit comfortably on a chair with the back supported and feet flat on the floor. The spine was maintained in an upright position, and the shoulders were kept relaxed and down.

Procedure

1. The participant was asked to turn the head approximately 45 degrees away from the side being stretched.
2. From this position, the participant gently flexed the neck forward, as if looking down toward the armpit.
3. To increase the stretch, gentle overpressure was applied using the hand on the back of the head, ensuring the movement remained slow and within a pain-free range.
4. The shoulder on the side being stretched was kept depressed to effectively isolate the levator scapulae muscle.

Dosage

The stretch was held for 15–30 seconds and then slowly released. It was repeated for the prescribed number of repetitions with adequate rest intervals between repetitions.
This stretching technique aimed to decrease muscle stiffness, reduce pain, and improve cervical range of motion. Regular stretching of the levator scapulae was intended to correct postural imbalances, reduce mechanical stress on the cervical spine, and enhance overall neck and shoulder function.

Scapular retraction exercises

Scapular retraction exercises were included in the conventional exercise program to strengthen the scapular stabilizing muscles, particularly the middle and lower trapezius and rhomboids, and to improve postural alignment. These exercises are essential for correcting rounded shoulder posture and reducing excessive load on the cervical and upper trapezius muscles.

Starting Position

The participant was instructed to sit or stand in an upright position with the spine in neutral alignment. The shoulders were relaxed, and the arms were placed comfortably by the sides or slightly abducted. The head was kept in a neutral position, facing forward.

Procedure

1. The participant was instructed to gently pull the shoulder blades backward and downward, as if trying to squeeze them together.
2. Care was taken to avoid shrugging the shoulders or arching the lower back during the movement.
3. The movement was performed slowly and in a controlled manner, emphasizing proper posture and muscle activation.
4. Once maximum comfortable retraction was achieved, the position was held for 5 seconds.
5. The participant then slowly relaxed and returned to the starting position.

Fig 4: Scapular Retraction Exercise

Dosage

The exercise was performed for 10 repetitions, with 2 sets, allowing adequate rest between sets.

Scapular retraction exercises help in improving scapular stability, enhancing postural control, and reducing muscle imbalance around the shoulder girdle. Strengthening these muscles contributes to better alignment of the cervical and thoracic spine, thereby reducing neck pain and improving functional activities.

Wall angel exercises

Wall angel exercises were incorporated into the conventional exercise program to improve postural alignment, shoulder mobility, and scapular stability. This exercise is particularly effective in correcting rounded shoulders, forward head posture, and upper back stiffness commonly seen in individuals with neck pain and trapezitis.

Starting Position

The participant was instructed to stand with the back against a wall in a comfortable position. The heels were placed a few centimeters away from the wall, while the head, upper back, and pelvis were maintained in contact with the wall. The knees were kept slightly flexed to maintain comfort. The arms were positioned at shoulder level with the elbows bent at 90 degrees, and the back of the hands and elbows were placed against the wall.

Procedure

1. The participant was instructed to gently draw the shoulder blades backward and downward to maintain contact with the wall.
2. From this position, the participant slowly moved the arms upward and downward along the wall, mimicking the motion of making a snow angel.
3. Throughout the movement, the participant was instructed to keep the head, upper back, elbows, and wrists in contact with the wall as much as possible.
4. Care was taken to avoid arching the lower back, shrugging the shoulders, or pushing the head forward during the movement.
5. The movement was performed slowly and within a pain-free range.

Dosage

The exercise was performed for 10 repetitions, with 2 sets, allowing adequate rest between sets.

Wall angel exercises help improve shoulder and thoracic mobility, enhance scapular control, and promote proper postural alignment. Regular performance of this exercise aids in strengthening the upper back muscles, reducing neck and shoulder strain, and improving functional movement patterns.

TheraBand exercises

TheraBand exercises were included in the conventional exercise program to strengthen the scapular stabilizers and shoulder girdle muscles, particularly the middle and lower trapezius, which play a crucial role in maintaining proper posture and reducing excessive load on the upper trapezius. Strengthening these muscles helps in pain reduction, correction of muscle imbalance, and improvement of functional activities in individuals with trapezitis.

Starting Position

The participant was instructed to sit or stand in an upright posture with the spine in neutral alignment. A TheraBand of appropriate resistance was secured firmly, either around a stable object or held in both hands. The shoulders were kept relaxed and away from the ears, and the head was maintained in a neutral position.

Procedure

1. The participant held the TheraBand with elbows flexed at 90 degrees, close to the body.
2. The forearms were moved outward against the resistance of the band while keeping the elbows tucked to the sides.
3. Scapular stability was maintained throughout the movement.

Dosage

Each exercise was performed for 10 repetitions, with 2 sets, allowing adequate rest between sets.

Precautions

- Avoid shoulder shrugging during exercises.
- Maintain proper posture throughout the session.
- Exercises were performed within a pain-free range.

TheraBand exercises help in strengthening the trapezius and surrounding musculature, improving scapular control, and reducing mechanical stress on the cervical region. Regular performance of these exercises' aids in long-term pain management, postural correction, and functional improvement in individuals with trapezitis.

Monitoring and Compliance-

All sessions for both groups were supervised by a trained physiotherapist to ensure correct execution of the intervention protocols. Participants were monitored for any discomfort or adverse effects during the sessions. Compliance was encouraged through regular supervision and verbal feedback.

Post-Intervention Assessment

At the end of the 4-week intervention period, all participants were reassessed using the same outcome measures that were recorded at baseline. The post-intervention data were collected to evaluate the effectiveness of Action Observation Therapy compared to conventional exercises in reducing pain and improving posture and functional outcomes.

Result

The collected data were systematically organized and analysed using appropriate statistical methods. Descriptive statistics, including mean and standard deviation, were calculated using StatistiXL version 2.0. Graphs and charts were prepared using Microsoft Excel and StatistiXL to facilitate clear data interpretation. A total of 53 participants were analysed (Group A: n = 27 – Action Observation Therapy; Group B: n = 26 – Conventional Exercise).

NPRS Score Comparison

Within-group analysis (Paired t-test):

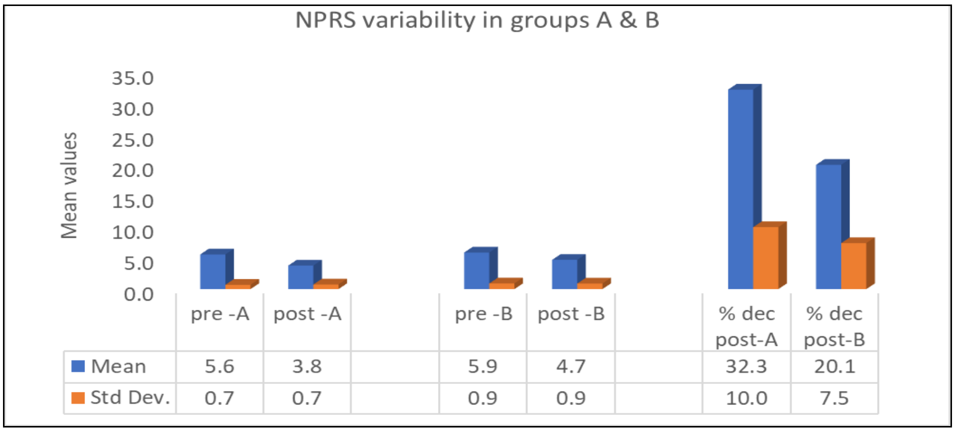
Group A: the mean NPRS score significantly reduced from 5.6 ± 0.7 (pre-test) to 3.8 ± 0.7 (post-test) ($t = 16.255$, $p < 0.001$), indicating effective pain reduction.

Group B: The mean NPRS score decreased significantly from 5.9 ± 0.9 to 4.7 ± 0.9 ($t = 12.741$, $p < 0.001$), demonstrating a significant reduction in pain following intervention.

Between-group analysis (Unpaired t-test) The mean percentage reduction in NPRS was significantly greater in Group A (32.3 ± 10.0%) compared to Group B (20.1 ± 7.5%). The mean difference was 12.19% ($t = 5.031$, $p < 0.001$). Thus, Group A showed significantly greater pain reduction than Group B, indicating that Action Observation Therapy was more effective than conventional exercises in reducing pain intensity.

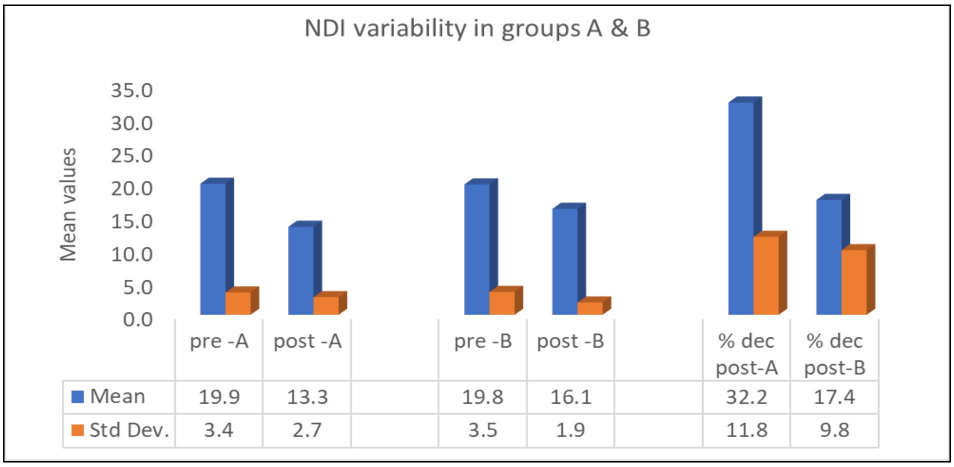
NDI Score Comparison

Within-group analysis (Paired-test):



	pre -A	post -A		pre -B	post -B		% dec post-A	% dec post-B
Mean	5.6	3.8		5.9	4.7		32.3	20.1
Std Dev.	0.7	0.7		0.9	0.9		10.0	7.5

Table 1: NPRS Score Comparison



	pre -A	post -A		pre -B	post -B		% dec post-A	% dec post-B
Mean	19.9	13.3		19.8	16.1		32.2	17.4
Std Dev.	3.4	2.7		3.5	1.9		11.8	9.8

Table 2. NDI Score Comparison

Group A

The mean NDI score showed a significant reduction from 19.9 ± 3.4 at pre-test to 13.3 ± 2.7 at post-test, with a mean difference of 6.54 ($t = 11.436$, $p < 0.001$), indicating a significant improvement in neck-related functional disability.

Group B

The mean NDI score also reduced significantly from 19.8 ± 3.5 to 16.1 ± 1.9 ($t = 7.534$, $p < 0.001$), demonstrating a significant improvement in neck-related disability following intervention. Between-group analysis (Unpaired t-test):

The mean percentage reduction in NDI was significantly higher in Group A (32.2 ± 11.8%) compared to Group B (17.4 ± 9.8%), with a mean difference of 14.77% ($t = 4.960$, $p < 0.001$). Thus, Group A showed significantly greater improvement in neck-related functional disability than Group B, indicating superior effectiveness of the intervention used in Group A.

Discussion

The present study evaluated the effectiveness of Action Observation Therapy (AOT) in reducing pain intensity and neck-related disability among school-going students aged 10–16 years suffering from trapezitis due to heavy school bag carriage. Both male and female students from 8th to 10th standard carrying school bags exceeding 10% of their body weight were included. All participants presented with neck and shoulder pain, upper trapezius tenderness, and restricted cervical range of motion. Pain and functional disability were assessed using the Numerical Pain Rating Scale (NPRS) and the Neck Disability Index (NDI), which are reliable and valid outcome measures for neck pain. The results showed statistically significant improvements in both groups; however, Group A (Action Observation Therapy) demonstrated greater reductions in pain and disability compared to Group B. Within-group analysis revealed a marked decrease in NPRS scores in Group A (5.6 ± 0.7 to 3.8 ± 0.7) compared to Group B (5.9 ± 0.9 to 4.7 ± 0.9). Between-group analysis confirmed a significantly higher percentage reduction in pain in Group A (32.3%) than Group B (20.1%) ($p < 0.001$). Similarly, NDI scores showed a greater improvement in Group A (32.2% reduction) compared to Group B (17.4% reduction), indicating superior functional recovery with AOT. The enhanced outcomes in Group A may be attributed to activation of the mirror neuron system through observation of correct neck and shoulder movements, leading to improved motor learning, posture awareness, and pain modulation. Action Observation Therapy is particularly suitable for children as it is visual, engaging, safe, and requires minimal physical effort. Clinically, AOT is cost-effective, easy to administer, and can be implemented in schools or outpatient settings. The findings support the use of AOT as an effective adjunct to conventional physiotherapy for managing trapezitis in school-going children and highlight its potential role in both rehabilitation and preventive school health programs.

Conclusion

The findings of the present study support existing evidence that Action Observation Therapy (AOT) is an effective neurorehabilitation approach for reducing pain and improving functional ability in musculoskeletal conditions. Observation of goal-directed movements activates the mirror neuron system, enhancing motor learning, movement execution, and pain modulation. The significant reduction in NPRS and NDI scores in Group A aligns with previous research demonstrating the benefits of AOT in neck pain and related disorders. While earlier studies focused mainly on adults, the present study extends these findings to school-going children with trapezitis caused by heavy school bags. The greater improvement in Group A suggests that AOT enhances the effectiveness of conventional physiotherapy. This highlights the importance of addressing both musculoskeletal and central motor control mechanisms, particularly in children with modifiable posture and movement patterns.

Limitations of the study

Despite the positive outcomes, the present study has certain limitations that should be considered while interpreting the results:

1. Short intervention duration-

The study assessed only short-term effects of Action Observation Therapy. Long-term follow-up was not conducted, so the sustainability of improvements in pain and disability could not be determined.

2. Limited sample size

The sample size was relatively small and restricted to a specific age group (10–16 years), which may limit the generalizability of the results to all school-going children.

3. Lack of objective outcome measures-

The study relied mainly on subjective outcome measures such as NPRS and NDI. Objective assessments like cervical range of motion measurement, posture analysis, or muscle strength testing were not included.

Future scope of the study

Based on the findings and limitations of the present study, the following recommendations are suggested for future research:

1. Long-term follow-up studies

Future studies should assess the long-term effectiveness of Action Observation Therapy to determine whether the improvements in pain and function are maintained over time.

2. Larger and diverse sample population-

Research involving a larger sample size and students from different schools and regions would improve the external validity of the findings.

3. Inclusion of objective outcome measures

Future studies may include objective assessments such as cervical range of motion, posture analysis, electromyography of the upper trapezius muscle, and functional performance tests. In conclusion, the present study demonstrates that Action Observation Therapy is a safe, simple, and effective intervention for reducing pain and neck-related disability in school-going students suffering from trapezitis due to heavy school bags. When combined with conventional physiotherapy, AOT provides superior outcomes compared to conventional treatment alone. Despite certain limitations, the study contributes valuable evidence supporting the use of AOT in paediatric musculoskeletal rehabilitation and highlights promising directions for future research.

Reference

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