Effect of shoulder bracing with Dumbbell for scapular dyskinesis among post operative breast cancer survivors

[1]Sujankumar S , 2Dr.Anitha A, [3] Kabilan R

[1]Undergraduate Student, Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences, Chennai 602105, Tamil Nadu, India.
[2]Assistant Professor, Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences, Chennai 602105, Tamil Nadu, India.
[3]Tutor, Saveetha College of Physiotherapy, Saveetha Institute of Medical and Technical Sciences, Chennai 602105, Tamil Nadu, India.

FUNDING STATEMENT :
There is no funding.

CONFLICT OF INTEREST:
The authors declare that they have no conflict of interests.

ACKNOWLEDGEMENT:
It gives me great pleasure to thank the department and all the people who have influenced and supported me in building my foundation for this research. I want to start by giving thanks to God, the Almighty, for his bountiful and wonderful grace that has enabled me to successfully finish this job. I would especially like to thank everyone who took part in the study; without you, the project could not have been completed.

ABSTRACT
BACKGROUND: Scapular dyskinesis is defined as abnormal static scapular position and/or dynamic scapular motion characterized by medial border prominence; inferior angle prominence and/or early scapular elevation or shrugging on arm elevation; and/or rapid downward rotation during arm lowering.
AIM: To determine the effect of shoulder bracing with Dumbbell for scapular dyskinesis among post-operative breast cancer survivors.
METHOD: Subjects were included based on the inclusion criteria. Out of 60 subjects, 30 were assigned to Shoulder bracing exercise with Dumbbell group which includes and 30 to Active shoulder exercise group. The treatment duration 45 minutes per session for 3 days / week of 4 weeks. Outcomes were assessed before the initiation of the intervention and after the completion of 4 weeks.
RESULT: The pretest and posttest values were analyzed using paired and unpaired t test and result suggested that shoulder bracing with Dumbbell group as shown significant improvement in NPRS, DASH and Goniometer among shoulder bracing exercise with Dumbbell group compared to active shoulder exercise group that has **p<0.0001**.
CONCLUSION: According to the studies finding individuals who have had breast cancer surgeries may benefit from shoulder bracing with Dumbbell than active shoulder exercise
KEYWORDS: Breast cancer, scapular dyskinesis, shoulder bracing, Dumbbell exercise.

INTRODUCTION:

Scapular winging, an irregular movement of the scapula within the thoracic wall, entails the inward rotation of the lower corner along the central axis and the protrusion of the upper, inner, or lower edge of the scapula. Scapular winging can arise from different factors, often attributed to weakened serratus anterior due to long thoracic nerve (LTN) injury, and weakened trapezius due to spinal accessory nerve injury, as frequently mentioned in literature . Additionally, shoulder diseases or pain can induce muscle imbalance, contributing to scapular winging. These factors disrupt the coordinated function of muscles responsible for stabilizing the scapula, leading to abnormal movement and positioning. Acknowledging the diverse origins of scapular winging is crucial for accurate diagnosis and targeted intervention, emphasizing the importance of addressing nerve injuries, muscle weaknesses, and underlying shoulder conditions to effectively manage and rehabilitate individuals experiencing this debilitating condition[1-4]. In addition to resistance for exercise[5]. The spinal accessory nerve, also referred to as cranial nerve XI, is responsible for the main motor innervation of the trapezius muscle . The trapezius is a crucial scapular stabiliser and offers passive support to the shoulder complex. The alignment of the shoulder is changed by trapezius weakening or paralysis, which also interferes with the shoulder complex's typical synchronous action. Shoulder soreness, restrictions on shoulder abduction, shoulder droop, and scapular winging are all symptoms of the "shoulder syndrome" caused by trapezius dysfunction[6-13]. Scapular dyskinesis (SD) involves deviations in scapular kinematics linked to various shoulder injuries, including impingement syndrome and rotator cuff tears. Contributors include bone, joint, nerve, and muscle issues, necessitating comprehensive assessment and tailored interventions. [14].

The surgical treatment of breast cancer impacts the strength and mobility of the upper limb on the side that underwent surgery[15,16]. One of the significant factors in preventing scapular winging and anterior scapular tilt is either the denervation of the long thoracic nerve, which makes it difficult to actively flex the shoulder beyond 120°, or the theoretical weakness of the serratus anterior (SA) muscles[17].

Prior studies found low SA occurrence (8%) post-BC surgery, but later research reported a high incidence (73.3%). Limited studies explore SD prevalence and its link to breast cancer[18]. For individuals with trapezius dysfunction brought on by injury to the spinal accessory nerve, shoulder strengthening was a key parts of physical therapy treatment[19]. Conflicting studies on scapular function's clinical significance stem from uncertain impacts on shoulder function. Multiple muscles attaching to the scapula enable varied degrees of freedom during arm movement.[20-21] Specialists define scapular dyskinesis as abnormal scapular position or movement. "Altered scapular resting position" is preferred for static assessment[22].

Scapula transfers energy from trunk, lower limbs, and core to arm muscles during movement[23].

Post-mastectomy, issues like altered scapular kinematics, muscle weakness, and limited shoulder movement impact functionality. Chemotherapy induces muscle weakening due to oxidative stress, emphasizing supportive interventions' importance[24].

In the assessment, the patient performs shoulder movements with resistance while observed for scapulohumeral rhythm. Dyskinesis is identified by abnormal patterns, like winging or dysrhythmia. Classification is based on observed movements[25]. To formulate treatment strategies, evaluating scapular dyskinesis comprehensively is crucial. Visual-based assessments, offering three-dimensional insights, are considered practical. Dyskinesis is categorized into four types[26]. Scapular dyskinesis causes abnormal motion, while humeral changes are typically due to rotator cuff muscle fatigue, leading to altered mechanics[27].

Dynamic tracking of the scapula during shoulder movement poses challenges due to limitations in digitizing and radiographic methods, which typically require static positioning and surface markers. The scapula's broad, flat shape and extensive soft tissue make using surface markers challenging[28]. Scapular dyskinesia, characterized by abnormal scapula positioning and disrupted movement rhythm, stems from factors like muscle weakness, nerve problems, and altered movement patterns. Research on its link to neuromuscular control is vital, especially for breast cancer survivors[29].

Post-mastectomy, scapular winging can arise, particularly after radical procedures removing axillary lymph nodes. Thoracic nerve damage to the serratus anterior muscle causes this. Scapular dyskinesia may lead to upper extremity dysfunction and shoulder pain[30].

MATERIAL AND METHODS:

Study procedure

The study was conducted at Saveetha medical college hospital, Thandalam. A total of 60 patients who underwent breast cancer surgery were included in the study based on the inclusion and exclusion criterion and were explained about the treatment safety and simplicity of the procedure and a written consent was obtained. Willing participants were randomly allocated into two group, which were Shoulder bracing with Dumbbell group and Active shoulder exercise group by lottery method. The treatment duration 45 minutes per session for 3 days / week of 4 weeks. Outcomes were assessed before the initiation of the intervention and after the completion of 4 weeks. Data were obtained and statistically analysed for interpretation of results.

SHOULDER BRACING WITH DUMBBELL GROUP: (n=30)

1. **Warm-up:** Begin with 5-10 minutes of gentle warmup exercises.

2. **Prone Y, T, and W Raises**

i. Lie face down on a bench. Hold light dumbbells with palms facing downward. Raise your arms into a “Y” position overhead, hold, then lower Raise your arms into a “T” position (straight out to the sides), hold, then lower Raise your arms into a “W” position (elbows bent at 90°), squeeze shoulder blades, then lower .Perform 2-3 sets of 10-15 reps.

ii. Dumbbell Serratus Punch:
Lie on your back with a dumbbell in one hand, arm extended toward the ceiling.Without bending the elbow, push the dumbbell further up by protracting your shoulder blade.
Lower back down slowly. Perform 2-3 sets of 12-15 reps per arm.

iii. Reverse Fly:
Stand with a dumbbell in each hand, bend slightly forward at the hips.With a slight bend in the elbows, lift your arms out to the sides.
Squeeze your shoulder blades together at the top, then lower.Perform 2-3 sets of 10-12 reps.

3. **Sets and Repetitions:** Start with 2-3 sets of 10-15 repetitions for each exercise. Gradually increase the number of repetitions and sets as you progress.

4. **Frequency:** Aim to perform these exercises 2-3 times per week, allowing for at least one day of rest between sessions.

5. **Cool-down:** Finish with gentle stretching of the shoulder and upper back muscles.

6. **Progression:** Increase the resistance of the Dumbbell exercise variations as per the progression of the treatment outcome.

ACTIVE SHOULDER EXERCISE GROUP: (n=30)

1. **Scapular Retraction Exercises:** These exercises focus on strengthening the muscles that retract the scapulae, such as the rhomboids and middle trapezius. Examples include scapular squeezes, seated rows, and face pulls.

2. **Scapular Protraction Exercises:** These exercises target the muscles responsible for protracting the scapulae, such as the serratus anterior. Examples include push-ups with protraction, scapular push-ups, and the "reach and roll" exercise.

3. **Scapular Stabilization Exercises:** These exercises aim to improve the stability of the scapulae by engaging the surrounding muscles. Examples include plank variations, shoulder stability ball exercises, and stability ball YWT exercises.

4. **Shoulder Mobility Exercises:** Improving shoulder mobility can also help alleviate scapular dyskinesis. Examples include shoulder circles, wall slides, and shoulder dislocations with a resistance band.

5. **Posture Correction Exercises:** Exercises that focus on correcting posture and aligning the shoulder girdle can also be beneficial. Examples include chin tucks, wall angels, and thoracic spine mobility exercises.

OUTCOME MEASURES:

Primary outcome measures: Pain was assessed using NPRS.

1. **The Numeric Pain Rating Scale (NPRS)** is a widely used tool in healthcare for assessing pain intensity. It's a simple scale where individuals rate their pain by choosing a number from 0 to 10, with 0 indicating no pain and 10 indicating the severe pain. Here's a breakdown of what each number typically represents:

0: No pain
1-3: Mild pain (annoying, nagging, uncomfortable)
4-6 : Moderate pain (interferes with daily activities, noticeable)
7-9 : Severe pain (disabling, debilitating, significantly affects daily activities)
10 : Worst possible pain

Secondary outcome measures:

Functional recovery measured using the Goniometer and DASH score.

2. **Goniometer**

Goniometer for the shoulder is specifically designed to measure the range of motion and angles of the shoulder joint. It typically consists of a protractor-like device with two arms, one of which is stationary while the other can move freely.

3. **DASH score**

The DASH (Disabilities of the Arm, Shoulder, and Hand) score is a self-reported questionnaire used to measure the disability and symptoms of individuals with musculoskeletal disorders of the upper extremity, including the arm,

shoulder, and hand. It assesses the impact of these disorders on a person's ability to perform activities of daily living and work-related tasks.

Each item is rated on a scale of 1 to 5, where 1 signifies no difficulty or symptom and 5 indicates inability to perform the activity or extremely severe symptoms.

RESULT:

After the data was tallied, the significant differences between the pre- and post-test measures were examined using the paired t-test for comparisons within groups and the unpaired t-test for comparisons between groups**.**

The statistical analysis shows that there is a moderate positive correlation in shoulder bracing with Dumbbell among post operative breast cancer survivors.

The post-test values of NPRS for group- A and Group B. The values were as follow for group A: post-test mean (3.00), SD (0.83), Group B posttest mean (5.00), SD (0.83). T -value was (9.3274). Because of this, the results are regarded as statistically significant when the p value is less than < 0.0001.

The post-test values of Goniometer (Flexion) for group- A and Group B. The values were as follow for group A: post-test mean (172.80), SD (1.75), Group B posttest mean (162.80), SD (1.75). T -value was (22.1329). Because of this, the results are regarded as statistically significant when the p value is less than < 0.0001.

The post-test values of Goniometer (Abduction) for group- A and Group B. The values were as follow for group A: post-test mean (147.00), SD (2.65), Group B posttest mean (136.80), SD (2.61). T -value was (15.0278). Because of this, the results are regarded as statistically significant when the p value is less than < 0.0001.

The post-test values of Goniometer (External rotation) for group- A and Group B. The values were as follow for group A: post-test mean (83.60), SD (1.89), Group B posttest mean (81.20), SD (1.19). T -value was (5.8992). Because of this, the results are regarded as statistically significant when the p value is less than < 0.0001.

The mean (53.40), SD (1.89), Group B posttest mean (59.00), SD (1.44). T -value was (12.9297). Because of this, the results are regarded as statistically significant when the p value is less than < 0.0001.

DISCUSSION:

The goal of the study was to help participants who had scapular dyskinesis among breast cancer survivors to reduce their pain and by improving shoulder function and overall upper limb performance.

Lang AE et al. (2022) found that breast cancer survivors display kinematic shifts, potentially predisposing to rotator cuff issues. Initially protective, compensatory movements may worsen over time. Surgery and pain impact scapular motion differently: mastectomy-pain group shows decreased upward rotation, while reconstruction-pain group shows increased. Time since surgery correlates with kinematic changes, emphasizing the need for nuanced reconstruction-focused analyses to understand rotator cuff disease risks[27]. Rizzi SK et al. (2016) found that winged scapula incidence post-surgery decreased from 8.0% to 3.3% over six months. It was more common in the axillary lymph node dissection (AL) group (22.6% vs. 2.9% in sentinel node biopsy group), but not significantly affected by surgery type. Presence of winged scapula correlated with shoulder impairment, irrespective of pain levels[31].

Borstad et al. (2012) found surgical interventions for breast cancer alter scapular internal rotation during arm elevation, impacting functional capabilities. Therapists should focus on rehabilitating scapula kinematics and enhancing shoulder range of motion. They recommend using tools like the Shoulder Rating Questionnaire for informed treatment decisions, aiming to improve shoulder function and quality of life in survivors[32]. Ribeiro et al. (2019) discovered breast cancer surgery patients exhibited reduced scapular upward rotation at 120 degrees arm elevation, along with limited shoulder external rotation range, strength in abduction and external rotation, compromised function, and decreased quality of life. They also reported pain during these movements, highlighting significant post-surgery challenges[33].

The results of this study offer strong evidence that individuals with breast cancer benefit significantly from pain, shoulder function and overall upper limb functional performance. These scapular exercises with Dumbbell have been demonstrated to promote shoulder function, reduce pain and improve upper limb functional performance.

CONCLUSION:

Research suggests that individuals who've undergone breast cancer surgeries could find more benefit in shoulder bracing with Dumbbell compared to active shoulder exercises. This method offers controlled resistance, targeting shoulder muscles and promoting stability without straining surgical sites. Unlike active exercises, shoulder bracing allows gradual strengthening, potentially improving range of motion with reduced discomfort. Given its affordability and accessibility, this approach stands as a promising rehabilitation strategy post-breast cancer surgery.

REFERENCES:

1. Kibler BW, Sciascia A, Wilkes T. Scapular dyskinesis and its relation to shoulder injury. JAAOS-journal of the American academy of orthopaedic surgeons. 2012 Jun 1;20(6):364-72.

2. Lee S, Savin DD, Shah NR, Bronsnick D, Goldberg B. Scapular winging: evaluation and treatment: AAOS exhibit selection. JBJS. 2015 Oct 21;97(20):1708-16.

3. Ribeiro EH. Associação entre discinesiasescapulares e lesões no ombro: revisão da literatura.

4. Bisson JI, Roberts NP, Andrew M, Cooper R, Lewis C. Psychological therapies for chronic post-traumatic stress disorder (PTSD) in adults. Cochrane database of systematic reviews. 2013(12).

5. Song SJ, Lim OB, Kim JA, Yong JH, Cynn HS, Yi CH. Effect of Craniocervical Flexion on Muscle Activities of Scapular Upward Rotator Muscle During Push-Up Plus Exercise in Subject With Winging of Scapula. Physical Therapy Korea. 2014 May 21;21(2):48-56

6. Remmler D, Byers R, Scheetz J, Shell B, White G, Zimmerman S, Goepfert H. A prospective study of shoulder disability resulting from radical and modified neck dissections. Head & neck surgery. 1986 Mar;8(4):280-6.

7. Herring D, King AI, Connelly M. New rehabilitation concepts in management of radical neck dissection syndrome: a clinical report. Physical Therapy. 1987 Jul 1;67(7):1095-9.

8. Miyata K, Kitamura H. Accessory nerve damages and impaired shoulder movements after neck dissections. American journal of otolaryngology. 1997 May 1;18(3):197-201.

9. Soo KC, Strong EW, Spiro RH, Shah JP, Nori S, Green RF. Innervation of the trapezius muscle by the intra-operative measurement of motor action potentials. Head & neck. 1993 May;15(3):216-21.

10. Williams Jr GR, Shakil M, Klimkiewicz J, Iannotti JP. Anatomy of the scapulothoracic articulation. Clinical Orthopaedics and Related Research (1976-2007). 1999 Feb 1;359:237-46.

11. Saunders WH, Johnson EW. Rehabilitation of the shoulder after radical neck dissection. Annals of Otology, Rhinology & Laryngology. 1975 Nov;84(6):812-6.

12. Köybasioglu A, Tokcaer AB, Uslu SS, Ileri F, Beder L, Özbilen S. Accessory nerve function after modified radical and lateral neck dissections. The Laryngoscope. 2000 Jan;110(1):73-7.

13. Johnson EW, Aseff JN, Saunders W. Physical treatment of pain and weakness following radical neck dissection. The Ohio State medical journal. 1978 Nov;74(11):711-4.

14. Acet N, Guzel NA, Keser I, Kurukahvecioglu O. Scapular dyskinesis in patients with breast cancer.

15. Knudsen B, Fischer MH, Aschersleben G. Development of spatial preferences for counting and picture naming. Psychological research. 2015 Nov;79:939-49.

16. Blanco-Montenegro I, De Ritis R, Chiappini M. Imaging and modelling the subsurface structure of volcanic calderas with high-resolution aeromagnetic data at Vulcano (Aeolian Islands, Italy). Bulletin of Volcanology. 2007 Apr;69:643-59.

17. Ludewig PM, Cook TM, Nawoczenski DA. Three-dimensional scapular orientation and muscle activity at selected positions of humeral elevation. Journal of Orthopaedic& Sports Physical Therapy. 1996 Aug;24(2):57-65.

18. Herring D, King AI, Connelly M. New rehabilitation concepts in management of radical neck dissection syndrome: a clinical report. Physical Therapy. 1987 Jul 1;67(7):1095-9.

19. Johnson EW, Aseff JN, Saunders W. Physical treatment of pain and weakness following radical neck dissection. The Ohio State medical journal. 1978 Nov;74(11):711-4.

20. Moore G. American College of Sports Medicine's Exercise Management for Persons With Chronic Diseases and Disabilities.

21. Ben Kibler W, SCIASCIA A. Current concepts: scapular dyskinesis. British journal of sports medicine. 2010;44(5):300-5.

22. Ludewig PM, Phadke V, Braman JP, Hassett DR, Cieminski CJ, LaPrade RF. Motion of the shoulder complex during multiplanar humeral elevation. JBJS. 2009 Feb 1;91(2):378-89.

23. Sciascia A, Thigpen C, Namdari S, Baldwin K. Kinetic chain abnormalities in the athletic shoulder. Sports medicine and arthroscopy review. 2012 Mar 1;20(1):16-21.

24. ZABİT F, İYİGÜN G. OP 8 Comparison of scapular dyskinesia and muscle strength between breast cancer survivor women who had mastectomy and healthy women.

25. Christiansen DH, Møller AD, Vestergaard JM, Mose S, Maribo T. The scapular dyskinesis test: Reliability, agreement, and predictive value in patients with subacromial impingement syndrome. Journal of Hand Therapy. 2017 Apr 1;30(2):208-13.

26. Deng S, Chen K, Ma Y, Chen J, Huang M. The influence of test positions on clinical assessment for scapular dyskinesis. PM&R. 2017 Aug 1;9(8):761-6.

27. Lang AE, Milosavljevic S, Dickerson CR, Trask CM, Kim SY. Evidence of rotator cuff disease after breast cancer treatment: Scapular kinematics of post-mastectomy and post-reconstruction breast cancer survivors. Annals of Medicine. 2022 Dec 31;54(1):1058-66.

28. McClure PW, Michener LA, Sennett BJ, Karduna AR. Direct 3-dimensional measurement of scapular kinematics during dynamic movements in vivo. Journal of shoulder and elbow surgery. 2001 May 1;10(3):269-77.

29. Korucu TS, Ucurum SG, Tastaban E, Ozgun H, Kaya DO. Comparison of shoulder-arm complex pain, function, and scapular dyskinesia in women with and without unilateral lymphedema after breast cancer surgery. Clinical Breast Cancer. 2021 Jun 1;21(3):e285-93.

30. Zabit F, Iyigun G. A comparison of physical characteristics, functions and quality of life between breast cancer survivor women who had a mastectomy and healthy women. Journal of back and musculoskeletal rehabilitation. 2019 Jan 1;32(6):937-45.

31. Giron PS, Haddad CA, Lopes de Almeida Rizzi SK, Nazário AC, Facina G. Effectiveness of acupuncture in rehabilitation of physical and functional disorders of women undergoing breast cancer surgery. Supportive Care in Cancer. 2016 Jun;24:2491-6.

32. Borstad JD, Szucs KA. Three-dimensional scapula kinematics and shoulder function examined before and after surgical treatment for breast cancer. Human movement science. 2012 Apr 1;31(2):408-18.

33. Ribeiro IL, Camargo PR, Alburquerque-Sendin F, Ferrari AV, Arrais CL, Salvini TF. Three-dimensional scapular kinematics, shoulder outcome measures and quality of life following treatment for breast cancer–A case control study. Musculoskeletal Science and Practice. 2019 Apr 1;40:72-9.