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The *WJCC* is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Current Contents®/Clinical Medicine, PubMed, PubMed Central, Scopus, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2022 Edition of Journal Citation Reports® cites the 2021 impact factor (IF) for *WJCC* as 1.534; IF without journal self cites: 1.491; 5-year IF: 1.599; Journal Citation Indicator: 0.28; Ranking: 135 among 172 journals in medicine, general and internal; and Quartile category: Q4. The *WJCC*'s CiteScore for 2021 is 1.2 and Scopus CiteScore rank 2021: General Medicine is 443/826.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Ying-Yi Yuan*; Production Department Director: *Xiang Li*; Editorial Office Director: *Jin-Lei Wang*.

NAME OF JOURNAL

World Journal of Clinical Cases

ISSN

ISSN 2307-8960 (online)

LAUNCH DATE

April 16, 2013

FREQUENCY

Thrice Monthly

EDITORS-IN-CHIEF

Bao-Gan Peng, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati, Ja Hyeon Ku

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

PUBLICATION DATE

November 26, 2022

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INSTRUCTIONS TO AUTHORS

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PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>

Influence of enhancing dynamic scapular recognition on shoulder disability, and pain in diabetics with frozen shoulder: A case report

Ayman A Mohamed

Specialty type: Rehabilitation

Provenance and peer review:
Invited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0
Grade B (Very good): B
Grade C (Good): C, C
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Ding W, United States;
Yu K, China

Received: August 30, 2022

Peer-review started: August 30, 2022

First decision: October 12, 2022

Revised: October 14, 2022

Accepted: October 27, 2022

Article in press: October 27, 2022

Published online: November 26, 2022



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Abstract

BACKGROUND

Frozen shoulder (FS) is a familiar disorder. Diabetics with FS have more severe symptoms and a worse prognosis. Thus, this study investigated the influence of enhancing dynamic scapular recognition on shoulder disability and pain in diabetics with FS.

CASE SUMMARY

A Forty-five years-old male person with diabetes mellitus and a unilateral FS (stage II) for at least 3 mo with shoulder pain and limitation in both passive and active ranges of motion (ROMs) of the glenohumeral joint of $\geq 25\%$ in 2 directions participated in this study. This person received dynamic scapular recognition exercise was applied to a diabetic person with a unilateral FS (stage II). The main outcome measures were upward rotation of the scapula, shoulder pain and disability index, and shoulder range of motion of flexion, abduction, and external rotation. The dynamic scapular exercise was performed for 15 min/session and 3 sessions/wk lasted for 4 wk. After 4 wk of intervention, there were improvements between pre-treatment and post-treatment in shoulder pain, shoulder pain and disability index, shoulder ROM, and upward rotation of the scapula.

CONCLUSION

This case report suggested that enhancing dynamic scapular recognition may improve shoulder pain and disability; upward rotation of the scapula; and shoulder ROM of shoulder abduction, flexion, and external rotation after 4 wk.

Key Words: Scapular recognition; Pain; Range of motion; Disability; Frozen shoulder; Case report

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Core Tip: Frozen shoulder (FS) is a common shoulder problem, diabetes mellitus (DM) causes more severe FS symptoms than patients without DM. This study investigated the influence of enhancing dynamic scapular recognition on shoulder disability, and pain in diabetics with FS.

Citation: Mohamed AA. Influence of enhancing dynamic scapular recognition on shoulder disability, and pain in diabetics with frozen shoulder: A case report. *World J Clin Cases* 2022; 10(33): 12410-12415

URL: <https://www.wjgnet.com/2307-8960/full/v10/i33/12410.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v10.i33.12410>

INTRODUCTION

Frozen shoulder (FS) is a common shoulder problem[1]. Diabetes mellitus (DM) causes more severe FS symptoms than patients without DM[2]. Also, DM causes worse outcomes and a prolonged course of treatment[3]. DM may lead to increased shoulder joint synovitis[4]. In DM, adipocytes produce cytokines and proteins such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- α). These proteins cause an overproduction of other pro-inflammatory cytokines, which exacerbate inflammation. Adipocytes also secrete excess IL-13, which causes synovial and connective tissue fibrosis[3].

Shoulder problems interest any researcher due to the complexity of shoulder motions that occur with interactions between the scapula, clavicle, and humerus[5]. Restriction in the capability to grasp overhead targets is a key problem in patients with FS leading to a significant restriction in performing their daily living activities and jobs, such as taking a shower and hair care[6].

FS causes an alteration in scapular position motion sense (proprioception)[7]. Patients with FS complain of an abnormal change in their scapular biomechanics as an increased lateral rotation of the scapula. This occurs due to the restriction in the range of motion (ROM) of the glenohumeral joint[8]. The persistent change in normal scapular biomechanics leads to additional harm to the muscle proprioception system, which consequently harms muscle spindles[9]. These muscle spindles are key sensory receptors in sensing joint position[10].

Research on motion and position sense yet has numerous unsolved questions; particularly, on rehabilitating shoulder proprioception in patients with FS[11]. Moreover, the association between the enhancement of proprioception and its therapeutic effect in patients with FS is not entirely understood [12].

Previously, we investigated the effect of a newly developed technique called dynamic scapular recognition on shoulder pain, range of motion, and disability in non-diabetics with FS[13]. Thus, this case study investigated the effect of this technique on shoulder pain, range of motion, and disability in diabetics with FS.

CASE PRESENTATION

Chief complaints

The patient complained of pain and limitation of range of motion in the shoulder joint.

History of present illness

The patient had a history of FS and DM.

Physical examination

Physical examination contained upward rotation of the scapula; shoulder pain and disability index (SPADI); and shoulder abduction, flexion, and external rotation (Figure 1).

Imaging examinations

Imaging examinations were performed and determined by the referring orthopedist.

FINAL DIAGNOSIS

The patient was diagnosed with FS and DM.



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Figure 1 Physical examination.

TREATMENT

The participant received 12 sessions of treatment. The treatment was in the form of dynamic scapular exercise that was performed for 15 min/session and 3 sessions/week lasted for 4 wk. The 3 sessions were performed every other day. The participant was instructed to stand up and perform the maximum possible active shoulder abduction by paying more attention to scapular movements. The therapist stood behind the participant and put one hand over the superior border of the scapula and the other hand on the inferior angle of the scapula to guide and correct any abnormal scapular movement.

OUTCOME AND FOLLOW-UP

The outcome measures included SPADI; upward rotation of the scapula; and shoulder abduction, flexion, and external rotation. After 4 wk of the intervention, there were improvements between pre-treatment and post-treatment in upward rotation of the scapula, SPADI; and shoulder ROM of flexion, abduction, and external rotation. The greatest improvement was in shoulder flexion 36%, while the least improvement was in shoulder external rotation 14% (Table 1).

DISCUSSION

This case study studied influence of enhancing dynamic scapular recognition on SPADI, upward rotation of the scapula, and shoulder abduction, flexion, and external rotation in diabetics with FS.

Upward rotation of the scapula

This case study suggested that enhancing dynamic scapular recognition may enhance the upward rotation of the scapula and lessen shoulder disability and pain after 4 weeks. This study is exclusive and innovative because it was the initial study to use a scapular recognition exercise on scapular motion, SPADI, and shoulder ROM in diabetics with FS.

In this case study, the dynamic scapular exercise enhanced the upward rotation of the scapula after 4 wk. This enhancement in the upward rotation of the scapula occurred due to the enhancement in central and peripheral recognition of scapular motion. The central mechanism was explained by Kaya[14] and Eriksson[15]. They found that proprioceptive training improves proprioceptive feedback by modifying muscle spindle mechanisms and stimulating plastic corrections in the central nervous system (CNS). Muscle spindles transfer data on the position and motion of the spinal cord[15]. Thus, it appears realistic to suppose that sensory data from muscle spindles play a crucial role in delivering data about both position sense and kinesthesia[15].

The role of muscle spindles decreases with immobility and injury. Janwantanakul *et al*[16] demonstrated that the sensitivity of muscle spindles decreases after suspension of the hindlimb in mice. This reduction occurred due to declining stiffness of both the muscle spindle and muscle-tendon unit. Conversely, Kaya[14] reported that regular training enhances muscle spindle signals, which leads to plastic modifications in the CNS. These plastic modifications include increasing the strength of connections in synaptic areas or/and structural modification in composition and network numbers in

Table 1 Dependent T-test between pre-treatment and post-treatment

	Pre-treatment	Post-treatment	Percentage of improvement
Upward rotation of scapula (degrees)	15.36	19.83	29%
Flexion (degrees)	79.03	108.12	36%
Abduction (degrees)	85.67	99.11	16%
Ex. Rotation (degrees)	44.13	50.32	14%
Shoulder pain and disability index (%)	99.00	80.00	23%

central neurons. Prolonged plastic modifications yield plastic regulations in the cortex. Over time, the cortical plots of the body change by enhancing the cortical image of the joints, producing a huge enhancement in joint proprioception.

Peripherally, proprioceptive training creates morphological modifications in muscle spindles themselves. These morphological modifications happen because of the micro-adaptations that happen in the intrafusal muscle fibers through metabolic changes[17].

SPADI

In this case study, there was a decline in pain and disability between pre-treatment and post-treatment findings. This decrease happened due to the enhancement in transmitting information from mechanoreceptors to the CNS through myelinated A-delta nerve fibers which are quicker than unmyelinated C fibers. Therefore, a block in the transmission of pain signals at the dorsal horn cell occurs (pain gate theory)[18]. Moreover, the improvement in scapular movements loosens the adhesions among the thorax and scapula leading to an improvement in movement and a decrease in disability[19]. In FS, the scapula moves upward to compensate for the lack of shoulder movement (dyskinesia); this decreases the normal upward rotation of the scapula leading to limited shoulder movements[20]. Thus, restoring the normal awareness of the patient about the proper movement of the scapula enhances its movements and decreases the adhesions formed between the scapula and thorax. Consequently, an improvement in the upward rotation of the scapula occurs leading to an improvement in overhead reach and daily living activities.

These study findings came followed the findings of earlier studies[5,16,21]. Dilek *et al*[22] found that using proprioception exercises in addition to any shoulder rehabilitation program for rotator cuff syndrome significantly increased shoulder ROMs.

Vallbo *et al*[21] reported that any effective rehabilitation protocol for shoulder disorders should focus on scapular movements and function because the integral role of the scapula is necessary for underlying feedback processes and motion sense that affect the subject's action and control. Inman *et al*[23] showed that the enhancement in scapula motion may play a little impact on shoulder motions that happen with no elevation of the shoulder since scapular motions and glenohumeral joint motions during the range of 60-65 degrees is small. Therefore, scapular movements are important in overhead movements.

Shoulder ROM

This case study found that there was an increase in shoulder abduction, flexion, and external rotation. These improvements caused by enhancing scapular dynamic recognition happened due to the restoration of normal scapular biomechanics and correction of the abnormal scapular elevation that occurs before the upward rotation of the scapula (shrug sign).

In detail, FS causes a reduction in the shoulder girdle motions in multiple planes[24]. Most overhead movements need complex, full, and synchronized movements of the whole shoulder girdle, not only the glenohumeral joint[25]. Scapular motions are one of the chief motions necessary to accomplish complete humerus-to-trunk and scapular-plane elevation[25]. Various studies[8,25,26] have revealed that FS causes alterations in scapular motions in the shape of initial scapular elevation with arm raise to recompense the reduced glenohumeral joint motion. Interventions to enhance upward rotation of the scapula help improve shoulder ROM.

This study's findings followed the findings of the study conducted by Surenkok *et al*[26]. They found that the improvement in scapular movements positively affects shoulder ROM.

The chief limitation in this case study was the participant's age. We went for this range of age as this is the usual age of FS. Also, we chose 80 degrees of shoulder abduction because abduction of 80 degrees or lower has little scapular movement involvement. Upcoming studies are considered necessary to conduct a randomized controlled study to reach a strong conclusion on this effect of the technique in diabetics with FS. Also, future studies should investigate the effect of this technique in other patients, for instance, patients with FS and cervical disorders or radiculopathy.

CONCLUSION

This case report suggested that enhancing dynamic scapular recognition may enhance shoulder disability and pain, scapular upward rotation, and shoulder abduction, flexion, and external rotation after 4 wk.

FOOTNOTES

Author contributions: Mohamed AA performed the study and wrote the manuscript.

Informed consent statement: Informed written consent was obtained from the patient for the publication of this report and any accompanying images.

Conflict-of-interest statement: The authors declare that they have no conflict of interest.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

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Country/Territory of origin: Egypt

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S-Editor: Chen YL

L-Editor: A

P-Editor: Chen YL

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