

**Deanship of Graduate Studies**

**Al-Quds University**



**The Effect of Kinetic Control Program Versus Rotator  
Cuff Muscle Imbalance-Based Program in  
Physiotherapy Management of Rotator Cuff  
Dysfunction -Experimental Comparative Study**

**Ayat Ameen Ata Amro**

**MPT Thesis**

**Jerusalem - Palestine**

**1445\2023**

**The Effect of Kinetic Control Program Versus Rotator  
Cuff Muscle Imbalance-Based Program in  
Physiotherapy Management of Rotator Cuff  
Dysfunction - Experimental Comparative Study.**

Prepared By:

**Ayat Ameen Ata Amro**

**B.Sc. Physiotherapy, Al-Quds University**

**Jerusalem - Palestine**

Supervisor

**Dr. Akram Amro**

**A thesis submitted in partial fulfillment of the  
requirement for the degree of Master of  
Physiotherapy - Deanship of Graduate Studies**

**Al-Quds University**

**1445/ 2023**

**Deanship of Graduate Studies**

**Al-Quds University**



**Thesis Approval**

**The Effect of Kinetic Control Program Versus Rotator  
Cuff Muscle Imbalance-Based Program in  
Physiotherapy Management of Rotator Cuff  
Dysfunction -Experimental Comparative Study.**

**Prepared by:** Ayat Ameen Ata Amro

**Registration Number:** 2112797

**Supervisor:** Dr. Akram Amro.

Master thesis submitted and accepted date:30 /12/2023 and approved by:

**Committee members**

**Signature**

**Head of the committee:** Dr. Akram Amro (AQU)

**Internal Examiner:** Dr. Abdulhamid Zeer (AQU)

*Abdulhamid*

**External Examiner:** Dr. Motaz Alwaneh (AAU)

*motaz*

**Jerusalem- Palestine**

**1445\2023**

## **Dedication**

At the beginning, I would like to dedicate my work to God; I am grateful for your protection, strength, direction, and mental power, and for providing me with a healthy existence.

To my beloved family especially My wonderful husband, Mouath, and our beloved sons Akram & and Zena, I appreciate your constant source of inspiration. Throughout this road, your spiritual, moral, and emotional assistance has been priceless to me. You have been my source of strength when I felt like giving up.

My parents, Ameen & Ghada your unwavering, constant support and encouragement have strengthened my resolve. My academic achievement has been fueled by your unwavering faith in me.

My amazing sisters and brothers your steadfast, never-ending encouragement and support have made me more determined. Your unflinching trust in me has been the driving force behind my academic success.

My siblings, friends, relatives, and work colleagues thank you for your words of advice and encouragement. They have been a source of strength and motivation during this challenging but rewarding endeavor.

This thesis is especially dedicated to Dr. Akram Amro Your encouragement and guidance have been instrumental in helping me stay motivated and focused throughout the completion of my thesis.

To the Al-Quds University family and doctors, your inspiration and support have helped me excel and grow as a researcher. I am truly grateful for the knowledge and guidance I have received during my academic journey.

This thesis embodies the culmination of hard work, dedication, and the unwavering support of those who believed in me. I am deeply grateful to every one of you.

## Declaration

This thesis is submitted in partial fulfillment of the requirement for the Master's degree in Physiotherapy.

I declare that the content of this thesis (or any part of the same) has not been submitted for a higher degree to any other University or institution.

Signed ...*Ayat Amro*.

Date 30/12/2023

## Acknowledgment

I want to thank Allah from the bottom of my heart for helping me finish my thesis successfully. Getting my master's degree has been the most difficult thing I have ever done. Overall, my master's program at Al-Quds University's Faculty of Health Professions has been a wonderful opportunity.

My fantastic supervisor, Dr. Akram Amro, has always been a tremendous mentor, guide, and supporter, and for that, I am very grateful. I am grateful to him for his understanding, encouragement, and suggestions, which helped me to continue with this study.

Also, I would like to express my gratitude to my supervisor and all of the other members of the physiotherapy master's degree committee, Dr. Abdulhamid Zeer, Dr.Hadeel Halaweh and Dr. Esra Hamdan, for their Acknowledgment , unwavering support, encouragement, and wisdom.

A special thank you to my coworkers at Alia Governmental Hospital for their support and encouragement while I was studying.

Finally, I express my gratitude to my patients for entrusting me with their care and time for assessment and treatment.

I appreciate all of your help during this important and exciting time in my career.

# **The Effect of Kinetic Control Program Versus Rotator Cuff Muscle Imbalance-Based Program in Physiotherapy Management of Rotator Cuff Dysfunction -Experimental Comparative Study**

**Prepared by : Ayat Ameen Ata Amro**

**Supervisor : Dr .Akram Amro**

## **Abstract**

**Background:** Rotator cuff dysfunction frequently occurs as a result of improper shoulder mechanics, fatigue, overload exercise, and excessive work in daily life, therefore it may limit functional movement of the upper extremities as a result of extreme pain, weakness, and deterioration of the shoulder stability. **Objectives.** The main objective of this study is to investigate the effect of a muscle imbalance-based exercise program compared to a kinetic control exercise program on pain severity, shoulder mobility, and functional outcomes among patients with shoulder tendinopathy. **Methods:** Experimental Comparative Study, the study was carried out at the Alia Governmental Hospital the study included 40 patients (males and females) with Rotator cuff Tendinopathy, aged 40 - 60 years. Patients were randomly assigned into two groups (by Excel software coding), all groups received 12 sessions at Hebron Governmental Hospital 3 days/week, the first group received a kinetic exercise control program, while the other group received a muscle imbalance-based exercise program. Patients were evaluated at the baseline and follow-up using the Western Ontario Rotator Cuff Index (**WORC**), Arabic Quick DASH questionnaire, Range of Motion (**ROM**), and pain level by a Numeric Rating Scale (**NRS**), Oxford Scale (**MMT**).

**Results:** patients in both groups improved significantly in all directions of range of motion, with statically significant improvement of abduction, lateral rotation, and cognitive movement-testing flexion (CMT) in the kinetic control program ( $p<0.05$ ). this improvement in lateral rotation and MCP flexion was predicted by being in the kinetic group and less BMI, while the abduction was predicted by being in the kinetic control group only. Muscle power improved in abduction, medial and lateral rotation, in the muscle imbalance group more than in the motor control group ( $p<0.05$ ). No statistically significant difference was found between any of the outcome measures mean improvement between the two groups.

**Conclusion:** Both techniques are effective in the management of rotator dysfunction, with more ROM outcomes associated with the kinetic control program

**Keywords:** Rotator cuff tendinopathy, Kinetic control, Muscle-imbalance Based exercise program.

# تأثير تمارينات التحكم الحركي مقابل التمارينات التقليدية في علاج ألام أوتار الكتف /دراسة تجريبية مقارنة

إعداد الطالب: آيات امين عطا عمرو

إشراف الدكتور: أكرم عمرو

## ملخص الدراسة باللغة العربية

**المقدمة:** يحدث التهاب أوتار الكتف بشكل متكرر نتيجة لميكانيكا الكتف غير الصحيحة والتعب او حمل الاوزان الثقيلة والعمل المفرط في الحياة اليومية، وبالتالي قد يحد من الحركة الوظيفية للأطراف العلوية نتيجة للألم الشديد والضعف وتدهور استقرار الكتف.

**هدف الدراسة:** معرفة تأثير تمارينات التحكم الحركي مقابل التمارينات التقليدية على شدة الألم وحركة الكتف والنتائج الوظيفية بين المرضى الذين يعانون من التهاب أوتار الكتف.

**منهج الدراسة:** دراسة تجريبية، أجريت في مستشفى عالية الحكومي في قسم العلاج الطبيعي للمراجعين في العيادات الخارجية في محافظة الخليل، وشملت الدراسة 40 مريضا (ذكورا وإناثا) يعانون من التهاب أوتار الكتف تراوحت أعمارهم بين 40 - 60 عاما. تم توزيع المرضى عشوائيا على مجموعتين عن طريق برنامج (Excel)، وتلقت جميع المجموعات 12 جلسة في مستشفى الخليل الحكومي بواقع ثلاث جلسات اسبوعيا، حيث تلقت المجموعة الأولى برنامج تمارينات التحكم الحركي للكتف، بينما تلقت المجموعة الأخرى برنامج تمرين قائم على علاج عدم التوازن العضلي. تم تقييم المرضى عند بداية التجربة والتقييم النهائي باستخدام مؤشر الكفة المدورة في غرب أونثاريو (WORC)، واستبيان DASH السريع باللغة العربية، ومدى الحركة (ROM)، ومستوى الألم بواسطة مقياس التصنيف الرقمي (NRS) وقوة العضلة باستخدام مقياس أكسفورد (MMT)

**النتائج:** تحسن المرضى في كلتا المجموعتين بشكل ملحوظ في جميع اتجاهات مدى الحركة، مع تحسن أفضل بشكل ثابت احصائيا في اختبار الرفع الجانبي والدوران الجانبي الخارجي للتحكم الحركي في الرفع الامامي. ( $p < 0.05$ ) تم التنبؤ بهذا التحسن في الدوران الجانبي لدى مجموعة التحكم الحركي ومؤشر كتلة الجسم الأقل، بينما تم التنبؤ بالحركة الجانبية من خلال في مجموعة التحكم الحركية فقط. كما تحسنت القوة في رفع اليد للجانبي والتدوير لكلا الجانبين في مجموعة توازن العضلات اكثر من مجموعة التحكم الحركي ( $p < 0.05$ ). لم يوجد فرق ذو دلالة إحصائية بين أي من المقاييس الوظيفية للتحسن بين المجموعتين .

**الخلاصة:** هناك تأثير معنوي لكلتا التقنيتين في تحسين الخلل الوظيفي لعلاج التهاب اوتار الكتف، مع نتائج مدى حركي أكثر في مجموعة التحكم الحركي.

**الكلمات المفتاحية:** التهاب اوتار الكتف، التحكم الحركي، برنامج التمارينات القائم على علاج اختلال التوازن العضلي.

## Table of Contents

Dedication .....	IV
Declaration .....	I
Acknowledgment.....	II
Abstract .....	III
ملخص الدراسة باللغة العربية .....	IV
Table of Contents .....	V
1. Chapter One Definition .....	2
1.1 Introduction .....	3
1.2 Problem Statement.....	5
1.3 Study Rationale .....	5
1.4 Study Objectives.....	6
1.5 Study Hypothesis.....	6
1.6 Terminology .....	6
2. Chapter Two Literature Review .....	7
2.1 Theoretical Framework .....	8
2.1.1 Rotator Cuff Dysfunctions .....	8
2.1.2 Rotator Cuff Common Injury .....	8
2.1.3 Risk factor for Rotator Cuff Dysfunction.....	9
2.1.4 Rotator Cuff Muscle Imbalance-Based Exercise.....	9
2.1.5 Kinetic Control Role in Shoulder Pain.....	10
2.2 Similar Studies .....	11
3. Chapter Three Methods and Materials .....	14
3.1 Introduction .....	15
3.2 Research Setting.....	15
3.3 Pilot Study .....	15
3.4 Methodology .....	15
3.4.1 Study Design .....	15
3.4.2 Study Tools.....	15
3.4.3 Outcome Measures .....	16
3.4.4 Data Collection Procedures .....	24
3.4.5 Intervention Procedures.....	27
3.5 Sampling and Population.....	28

3.5.1	Sampling Method .....	28
3.5.2	Sample Size .....	28
3.5.3	Inclusion Criteria.....	29
3.5.4	Exclusion Criteria.....	29
3.6	Ethical Consideration .....	29
3.7	Statistical Analysis .....	30
4.	Chapter Four Result Presentation, Analysis and Discussion.....	31
4.1	Descriptive Statistics of variables .....	32
4.1.1	Age of Participants. ....	32
4.1.2	Gender of Participants. ....	32
4.1.3	Diagnosis of the Participant.....	33
4.1.4	BMI of Participants. ....	34
4.1.5	Occupation of the Participants.....	35
4.1.6	History of Smoking .....	36
4.1.7	History of Diabetes.....	36
4.2	Normality distributed of the parametric data.....	37
4.3	Inferential statistical analysis of the tested variables.....	38
4.3.1	Static Muscle Strength.....	38
4.3.2	Range of Motion.....	41
4.3.3	Scapular Clinical Static Test.....	57
4.3.4	Numeric Rating Scale.....	60
4.3.5	Quick DASH Questionnaire .....	62
4.3.6	Western Ontario Rotator Cuff Index (WORC).....	63
4.3.7	Orthopedic Tests of both groups (at baseline and follow-up) .....	65
4.4	Differences in mean between two groups in terms of all research variable improvement 66	
4.5	Multi-variate analysis (regression) for predictors of improvement.....	67
4.5.1	CMT Flexion Improvement Multivariate Analysis .....	67
4.5.2	Abduction Improvement Multivariate Analysis .....	68
4.5.3	Lateral Rotation Improvement Multivariate Analysis.....	69
4.5.4	Difference of mean improvement of the main outcome measures of the two groups combined according to the diagnosis.....	70
4.6	Discussion .....	73
4.7	Study Limitations .....	77

5. Chapter Five Conclusion and Recommendation .....	78
5.1 Conclusion:.....	79
5.2 Recommendations .....	79
Appendix 1: Assessment Sheet .....	81
Appendix 2: Numeric Rating Scale .....	85
Appendix 3: Arabic Quick DASH questionnaire .....	86
Appendix 4: Western Ontario Rotator Cuff Index (WORC).....	88
Appendix 5: Muscle-Imbalance-Based exercise Group .....	90
Appendix 6: Arabic Muscle-Imbalance-Based Exercise Group.....	103
Appendix 7: Exercises Kinetic control program: .....	109
Appendix 8: Arabic Kinetic control program:.....	116
Appendix 9: Ethical Committee Approval. ....	118
Appendix 10: Research Information Sheet.....	119
Appendix 11: Constant Form .....	120
References .....	121

# 1. List of Figure

Figure 3-1 Active Range of Motion for Shoulder.....	18
Figure 3-2 Movement Control test for shoulder Flexion.....	18
Figure 3-3 Movement Control test for shoulder Abduction.....	18
Figure 3-4 Manual Muscle Testing For Shoulder Movement.....	19
Figure 3-5 Neer's impingement sign.....	21
Figure 3-6 Hawkins–Kennedy test.....	21
Figure 3-7 Painful Arc Test.....	21
Figure 3-8 Empty Can Test.....	22
Figure 3-9 Full Can Test.....	22
Figure 3-10 Distance between medial scapular boarder and T4.....	22
Figure 3-11 Distance between Acromion and Table.....	23
Figure 3-12 Numeric Rating scale.....	23
Figure 3-13 Flow chart of the participants.....	26
Figure 4-1 Mean Age of the Participants.....	32
Figure 4-2 Gender of Participants.....	33
Figure 4-3 Diagnosis of the Participant.....	33
Figure 4-4 BMI of Participant.....	34
Figure 4-5 BMI Categories of the Participants.....	35
Figure 4-6 The Participant's Occupation.....	35
Figure 4-7 Smoking History.....	36
Figure 4-8 History of Diabetes.....	36
Figure 4-9 Variation of Mean T2 Between the Groups at follow up.....	40
Figure 4-11 Shoulder Flexion variation.....	42
Figure 4-12 Cognitive Movement-testvariation.....	43
Figure 4-13 Shoulder Abduction variation.....	45
Figure 4-14 CMT Shoulder Abduction Variation.....	46
Figure 4-15 Shoulder Extension Variation.....	48
Figure 4-16 CMT Extension variation.....	49
Figure 4-17 Shoulder Medial Rotation Variation.....	51
Figure 4-18 CMT Shoulder Medial Rotation variation.....	52
Figure 4-19 Shoulder Lateral Rotation Variation.....	54
Figure 4-20 CMT Lateral Rotation variation.....	55
Figure 4-21 Distance between medial scapular border and T4 variations.....	57
Figure 4-22 Distance between Acromion and Bed variations.....	59
Figure 4-23 Numeric Rating Scale.....	60
Figure 4-24 Quick DASH Questionnaire variations.....	62
Figure 4-25 Western Ontario Rotator Cuff Index variation.....	63
Figure 4-26 percentage of positive tests at follow-up.....	65
Figure 4-27 Distance between Medial Scapular Border and T4 improvement according to diagnosis.....	71
Figure 4-28 NRS improvement according to diagnosis.....	71
Figure 4-29 QDASH Improvement According to Diagnosis.....	72

## 2. List of Tables

Table 3-1 Shoulder Range of Motion Assessment .....	16
Table 3-2 Shoulder Muscle Power Assessment.....	20
Table 4-1 Normality Test .....	37
Table 4-2 Distribution of Static Muscle Strength By Grade Between the Groups .....	38
Table 4-3 Statistical results of Wilcoxon Signed Ranks Test for Testing Improvement of Static Muscle Strength within the Groups between T1 and T2 .....	39
Table 4-4 Difference of Mean Manual Muscle Testing at T2 Between Groups.....	40
Table 4-5 Differences of mean between two groups at baseline of all research variable .....	41
Table 4-6 Statistical results of paired sample t-test for Testing Shoulder flexion within groups at baseline and follow-up.....	42
Table 4-7 Statistical results of independent sample t-test for Testing Shoulder flexion at follow-up between groups .....	43
Table 4-8 Statistical results of paired sample t-test for Testing CMT of shoulder flexion within groups at baseline and follow-up.....	44
Table 4-9 Statistical results of independent sample t-test for Testing Shoulder CMT flexion at follow-up between groups .....	44
Table 4-10 Statistical results of paired sample t-test for Testing Shoulder Abduction within groups at baseline and follow-up.....	45
Table 4-11 Statistical results of independent sample t-test for Testing Shoulder Abduction at follow-up between groups .....	46
Table 4-12 Statistical results of paired sample t-test for Testing CMT of Shoulder Abduction within groups at baseline and follow-up.....	47
Table 4-13 Statistical results of independent sample t-test for Testing Shoulder Abduction at follow-up between groups .....	47
Table 4-14 Statistical results of Wilcoxon Signed Ranks Test for Testing Shoulder Extension at baseline and follow-up.....	48
Table 4-15 Statistical results of Mann-Whitney U Test for Testing Shoulder Extension at Baseline and follow-up .....	49
Table 4-16 Statistical results of paired sample t-test for Testing CMT of Shoulder Extension within groups at baseline and follow-up.....	50
Table 4-17 Statistical results of independent sample t-test for Testing Shoulder CMT Extension at follow-up between groups .....	50
Table 4-18 Statistical results of paired sample t-test for Testing of Shoulder Medial Rotation within groups at baseline and follow-up.....	51
Table 4-19 Statistical results of independent sample t-test for Testing Shoulder Medial Rotation at follow-up between groups .....	52
Table 4-20 Statistical results of paired sample t-test for Testing of CMT Shoulder Medial Rotation within groups at baseline and follow-up.....	53
Table 4-21 Difference of mean in CMT medial rotation at follow-up between groups .....	53
Table 4-22 Statistical results of paired sample t-test for Testing of Shoulder Lateral Rotation within groups at baseline and follow-up.....	54
Table 4-23 Statistical results of independent sample t-test for Testing Shoulder Lateral Rotation at follow-up between groups .....	55
Table 4-24 Statistical results of paired sample t-test for Testing of CMT Shoulder Lateral Rotation within groups at baseline and follow-up .....	56
Table 4-25 Statistical results of independent sample t-test for Testing Shoulder CMT Lateral Rotation at follow-up between groups .....	56

Table 4-26 Statistical results of paired sample t-test for Testing Distance between the medial scapular border and T4 within groups at baseline and follow-up .....	58
Table 4-27 Statistical results of independent sample t-test for Testing Distance between the medial scapular border and T4 at follow-up for both group .....	58
Table 4-28 Statistical results of paired sample t-test for Testing Distance between Acromion and Bed .....	59
Table 4-29 Statistical results of independent sample t-test for Testing Distance between the acromion and bed at follow-up for both groups .....	60
Table 4-30 Testing Numeric Rating Scale at baseline and follow-up .....	61
Table 4-31 Statistical results of Mann-Whitney U Test for Testing Numeric Rating Scale at baseline and follow-up .....	61
Table 4-32 Statistical results of Wilcoxon Signed Ranks Test for Testing Quick DASH at baseline and follow-up .....	62
Table 4-33 Statistical results of Mann-Whitney U Test for Testing Quick DASH Questionnaire at baseline and follow-up.....	63
Table 4-34 Statistical results of Wilcoxon Signed Ranks Test for Testing WORC at baseline and follow-up .....	64
Table 4-35 Statistical results of Mann-Whitney U Test for Testing WORC at baseline and follow-up.....	64
Table 4-36 percentage of positive tests in baseline and follow-up in both groups .....	65
Table 4-37 Statistical results paired-samples t-test for Testing Improvement in all research variable.....	66
Table 4-38 Multivariate Regression of CMT Flexion Improvement.....	67
Table 4-39 Multivariate Regression of Abduction improvement .....	68
Table 4-40 Multivariate Regression of Lateral Rotation Improvement.....	69
Table 4-41 Variation of improvement based on diagnosis .....	70

## **1. Chapter One: Definition**

**1.1 Introduction.**

**1.2 Problem Statement.**

**1.3 Study Hypothesis.**

**1.4 Study Objectives.**

**1.5 Study Rational.**

**1.6 Terminology.**

## 1.1 Introduction

Shoulder disorders are popular musculoskeletal problems in Western society, which have a 1-year prevalence of 47% and a lifetime incidence of up to 70% reported one of the most prevalent causes of shoulder pain rotator cuff tendinopathy (Leong et al., 2019). which produces discomfort and weakness during external rotation and elevation. Rotator cuff tendinopathy frequently may occur because of several reasons and etiologies, including but not limited to compensatory movements, improper shoulder mechanics, fatigue, overload exercise, and excessive work of daily life (Yi et al., 2021). Vascular and metabolic diseases, as well as alterations in collagen fibers brought on by overuse—particularly with repetitive lifting—are the causes of pathological alterations in tendons. faulty technique when engaging in shoulder exercises, Instability in the shoulders (muscle imbalance/weakness), Poor posture and/or weakened back muscles that cause the shoulder blade to tilt forward, aggravating the impingement, Injury/Trauma, and degenerative arthritis that may lead to rupture(Chianca et al., 2018). Tendons are characterized by high mechanical strength and rigid structure with a fibrous elasticity, therefore the structure of the rotator cuff tendon is closely related to its function which is represented in connecting the rotator muscle group to the humerus bone and minimizing the risk of shoulder injuries (Liu et al., 2018). Literature argued extensively that imbalance of initiation of scapular movement leads to shoulder dysfunction and can lead to rotator cuff tendinopathy (Burkhart et al., 2003) (Ryösä, Laimi, Äärilä, Lehtimäki, Lewis, et al., 2018).

Rotator cuff disease can cause severe discomfort, weakness, and a decline in the stability of the shoulder, which can restrict the upper extremities' functional range of motion. (Gowd et al., 2018). The medical management of the tendinopathy could be medications and, or physiotherapy rehabilitation(Joossens & Struyf, 2015). Physiotherapy as a health care profession uses different methods in treating RCT tendinopathy; conventional physical therapy such as hot packs, or ice packs, electrical stimulation(Desmeules et al., 2016)(Page et al., 2016) massage(Roy & Frémont, 2015), US(Ebenbichler et al., 1999), regardless to poor evidence of effectiveness of these modalities for shoulder tendinopathy (Cardoso et al., 2019), recent studies highlight the efficiency of shoulder and scapular biomechanics in the management of the shoulder tendinopathy pain and dysfunction (Saito et al., 2018).

The main goals of therapeutic exercise in treating muscular problems are to maintain flexibility, remove limitations (particularly after myofascial stretching or manual therapy mobilization), control pain and symptoms (support or unload tissues that are sensitive to pain), regulate segmental articular movements (local muscle system motor control), regulate aberrant motion - unauthorized range or direction (global muscular system motor control) recuperate from atrophy, recondition, and withstand load (boost strength and endurance), manage speed (increase acceleration and manage momentum), develop and practice sport-specific abilities (coordination and skill), and to improve one's mood and feeling of wellness to help manage behavioral and emotional disorders (Pedersen & Saltin, 2015)(Challoumas et al., 2020)(Page et al., 2014)

Kinetic control by definition from the Kinetic control approach point of view, is the range of motion of the angle at which the patient can perform a movement without losing the neutral position (no compensation by other muscles). It is well known that at the moment that compensatory movements are performed, the trajectory of the movement is changed which lays challenging load distribution on the tendons, ligaments, and joints, which may contribute to different dysfunctions in the above-mentioned structures (degenerative changes and tendinopathy). (Richardson et al., 2020)

The kinetic intervention itself is based on the notion of applying the movement for two minutes of repetition twice a day. With the logic of training in neutral, without fatigue, as the moment that fatigues take place, the body by default searches for compensatory maneuvers, that have a degenerative effect both on the joint and tendons related to a particular movement. (Ryösä, Laimi, Äärimaa, Lehtimäki, Uhl, et al., 2018)

When the neural and biomechanical components of the targeted muscles positively change in terms of strength, recruitment, and synergy, it will eventually lead to an improved motor control pattern, where further ranges can be performed with a full ROM of requested movement without compensation, which in turn would allow for better movement biomechanics with less compressive forces on tendons and joints, which ultimately will lead to improved pathology and dysfunction in impaired tendons. (Riemann & Lephart, 2002)

## **1.2 Problem Statement**

Physical therapy including general shoulder exercises used to relieve pain and improve functional ability in many musculoskeletal problems, including muscular impairment, joint dysfunction, and tendinopathy including different rotator cuff dysfunctions. Generally, less attention is paid to evaluating scapular dysfunction, neck, and trunk, which are significant factors associated with shoulder pain (Littlewood, May, et al., 2013)

Most of the literature had failed to prove the effectiveness of passive modalities in physiotherapy in the management outcome of rotator cuff dysfunction, with moderate evidence on the effectiveness of muscle imbalance-based physiotherapy protocols (Richardson et al., 2020) while Kinetic control for rotator cuff dysfunction is a modern approach with strong evidence on back pain related dysfunction (Comerford & Mottram 2011), there is a gap of knowledge regarding the evidence on its effectiveness of application on shoulder tendinopathy management. Furthermore, evidence on the effectiveness of scapular control as an intervention in the management of rotator cuff dysfunction is still lacking (Hik et al., 2020).

Therefore, this study investigates the effect of kinetic control of the glenohumeral joint and its effectiveness on rotator cuff tendinopathy, which may help in highlighting its importance in preventing further complications and promoting functional outcomes in Rotator cuff tendinopathy.

## **1.3 Study Rationale**

The results of this study will be useful for different sectors, including therapists and patients as an integral part of the rehabilitation process, by highlighting the importance of an etiology-based intervention that could be held at both the clinic and home setting in a combined effort of both the therapist and patients to overcome the contributing factors of tendinopathy rather than treating its symptoms.

## **1.4 Study Objectives**

The main objectives of this study are:

1. To investigate the effect of muscle imbalance-based Shoulder Exercise program on pain and functional outcome of Rotator cuff dysfunction treatment.
2. To investigate the effect of a Kinetic control program on pain and functional outcome of Rotator cuff dysfunction treatment.
3. To investigate the difference in RCT rehabilitation outcomes between the kinetic control program and the muscle imbalance-based program
4. To investigate the effect of personal and anthropometric variables on the rehabilitation outcome of rotator cuff dysfunction.

## **1.5 Study Hypothesis**

1. Muscle-imbalance-based Shoulder Exercise program is significantly effective in improving pain and functional outcome of Rotator cuff dysfunction.
2. Kinetic control is significantly effective in improving pain and functional outcomes of Rotator cuff dysfunction.
3. There is a statistically significant difference in RCT rehabilitation outcomes between the kinetic control program and the muscle imbalance program
4. Personal and anthropometric variables significantly affect the treatment outcome of rotator cuff dysfunction.

## **1.6 Terminology**

RCT: Rotator Cuff Tendinopathy

VAS: Visual Analogue scale

NRS: Numeric Rating Scale

CMT: Cognitive Movement-test

WORC: Western Ontario Rotator Cuff Index

## **2. Chapter Two Literature Review**

### **2.1 Theoretical Framework.**

**2.1.1** Rotator Cuff Dysfunctions

**2.1.2** Rotator Cuff Common Injury

**2.1.3** Risk Factor for Rotator Cuff Dysfunction

**2.1.4** Rotator Cuff Muscle Imbalance-Based Exercise

**2.1.5** Kinetic Control Role in Shoulder Pain

### **2.2 Similar Studies.**

## 2.1 Theoretical Framework

The shoulder joint is a complex articulation between the proximal end of the humerus and the glenoid fossa of the scapula (Javed et al., 2022) it's also called the "Glenohumeral joint", This joint plays a very important role in the articulation of the upper extremity with the trunk (Bakhsh & Nicandri, 2018), shoulder classified as a ball and socket joint their shape allows a large Range of motion. As bony anatomy of the shoulder provides slight stability (Trivedi et al., 2014). Also, **the** muscular component around the shoulder provides dynamic stability by Rotator Cuff Muscles (supraspinatus, subscapularis, teres minor, and infraspinatus) (Mottram; S.L, 1997). The shoulder joint should be maintained in the anatomical position to maintain neutral controlled movements which is achieved by proper scapular stabilization and mobilization (Hik & Ackland, 2019), by increasing upper trapezius control, decreasing control of the lower trapezius and serratus anterior (McClure et al., 2006).

The most frequent cause of shoulder pain, weakness of shoulder muscle, and a restricted range of motion in the shoulder joint is rotator cuff tendinopathy; these symptoms can have a detrimental effect on the patient's quality of life and functional impairment. The goals of physiotherapy as a health care profession tend to involve managing rotator cuff tendinopathy to reduce pain, reduce inflammation, restore optimal movement and function, and raise awareness of appropriate exercise to prevent the recurrence of the shoulder problem

### 2.1.1 Rotator Cuff Dysfunctions

Juerg Hodler pronounced that rotator cuff tendinopathy is irritation and inflammation of the rotator cuff tendon which is frequently occurred as a result of intrinsic and extrinsic factors or both, usually, most patients experienced localized pain, muscle weakness, limited range of motion especially flexion, external rotation, and overhead activities. Moreover, patients usually reported sleep disturbance due to pain (Kubik-huch & Schulthess, 2021).

### 2.1.2 Rotator Cuff Common Injury

The most common injuries to the Rotator Cuff are often referred to as **Impingement syndrome** which is described as biomechanics dysfunction of the shoulder complex resulting in improper wear and strain on the RC soft tissue, **Rotator Cuff Tendinitis** which

is acute inflammation of the Rotator cuff soft tissue, **Rotator Cuff Tendinopathy** described as chronic irritation or degeneration of the Rotator cuff soft tissue, and **Rotator Cuff Tears** partial or full thickness tearing of the muscles or tendons. (Tytherleigh-strong et al., 2001)

### 2.1.3 Risk factor for Rotator Cuff Dysfunction

evidence submitted that aging and their related vascularity changes(Rudzki et al., 2008), systematic disorders such as diabetes (Sayampanathan & Andrew, 2017)(Lin et al., 2015), osteoarthritis(Leong et al., 2019), hypertension(Giri et al., 2022), cardiovascular disease(Applegate et al., 2017), excessive tissue loading on the dominant hand (Sayampanathan & Andrew, 2017) increased chance to have rotator cuff tendinopathy as an intrinsic risk factor. In addition, predisposing extrinsic risk factors may also increase the risk of tendinopathy such as sport overhead activity (Leong et al., 2019), heavy manual work (Rodriguez Diez-Caballero et al., 2020), vibration work (Sutinen et al., 2006), smoking(Grusky et al., 2022), obesity(Macchi et al., 2020), psychological factor (Mallows et al., 2017).

Many studies have highlighted the relationship between both intrinsic and extrinsic factors which appear when there is scapular malalignment and rotator muscle fatigue, that's will lead to a decrease in the space Glenohumeral joint and swelling in the supraspinatus tendon(Muth et al., 2012) (Lewis et al., 2015).

### 2.1.4 Rotator Cuff Muscle Imbalance-Based Exercise

Many studies have examined the efficacy of exercise in treating rotator cuff dysfunction. The term "exercise" encompasses a wide range of therapeutic approaches, such as physiotherapy modalities, stretching, and strengthening exercises. Reducing muscle imbalance, easing pain, building strength, and improving muscle coordination are the goals of a shoulder exercise program for physiotherapy. (Kuhn, 2009a) so exercise targeted the following muscle groups around the shoulder, Deltoid located front, back, and over the shoulder, Rhomboid muscles in the upper back, Trapezius muscles in the upper back), Teres muscles, Supraspinatus, Infraspinatus support the shoulder joint, and Subscapularis support the front of the shoulder. (Javed et al., 2022)

To treat rotator cuff dysfunction, Kuhn conducted a systematic review and produced an evidence-based rehabilitation protocol as the gold standard rehabilitation protocol. This protocol includes a specific exercise program that has statistically and clinically important impacts on pain reduction and improving function. (Kuhn, 2009b)

Rotator cuff and shoulder conditioning program modified by the American Academy of Orthopedic Surgeons to remain shoulder joint stable by strengthening the muscles that support the shoulder, to ease shoulder discomfort and prevent additional harm. In addition to flexibility training to regain range of motion and avoid injury, it's critical to stretch the muscles after strengthening to assist in minimizing discomfort and maintain muscles long and flexible. (AAOS, 2012)

Littlewood et al. conducted a study of the scientific literature in 2013 to determine how to treat rotator cuff tendinopathy. And result that therapeutic exercise in physical therapy may be useful in the treatment of rotator cuff tendinopathy(Littlewood, May, et al., 2013)

#### **2.1.5 Kinetic Control Role in Shoulder Pain**

For a long time, physiotherapists' main objectives in treating shoulder girdle discomfort and dysfunction were to relieve symptoms, improve function, and restore movement. Generally, they neglected to evaluate scapular dysfunction, trunk, and leg movement, which are significant factors associated with shoulder pain (Struyf, Cagnie, et al., 2014) Recently, Kinetic control for shoulder functional impairment been more concerned with restoring functional and dynamic mobility (a biomechanical pattern) rather than doing isolated muscle activities(McMullen & Uhl, 2000).

Sarah Mottram describes the role of management and treatment of uncontrolled movement in the shoulder joint to effectively treat symptoms and dysfunction in a shoulder dysfunction (Comerford & Mottram, 2012)

Littlewood et al. Studied the role of the central nervous system as an additional factor in treating rotator cuff tendinopathy and a possible establishment for understanding how the body responds to shoulder-related pain. This additional consideration provides an approachable method to comprehend the discomfort brought on by rotator cuff

tendinopathy as well as the processes underlying the therapeutic response to heavy exercise. (Littlewood, Malliaras, et al., 2013)

Therefore, proprioception exercises, scapular stability exercises, and scapular muscle strengthening should be linked as additional important components of shoulder rehabilitation therapeutic interventions (Yamauchi et al., 2015).(Dominguez-Romero et al., 2018)

The shoulder, scapulothoracic, hip, and pelvic muscles are all activated during a common functional shoulder movement, according to electromyography research so it's recommended to focus on the role of scapular interventions to improve shoulder pain and function. (Richardson et al., 2020)

## **2.2 Similar Studies**

The goal of a normal rehabilitation program is to locate the implicated structures and treat them. The body, however, functions as a dynamic system in everyday activities and athletic endeavors rather than as discrete parts. Recent rehabilitation regimens have placed a strong emphasis on functional exercises, core stabilization activities, and closed kinetic chain exercises. These elements are employed after the rehabilitation program and are implemented as separate entities. (McMullen & Uhl, 2000)

To treat rotator cuff tendinopathy conservatively, exercise programs were conducted as a gold-standard rehabilitation strategy, Kuhn examined 11 randomized controlled studies (levels 1 and 2), about the effectiveness of exercise in the treatment of rotator cuff impingement and a typical evidence-based rehabilitation regimen was developed, following a thorough evaluation of the literature. Exercise's role in the treatment of impingement Statistics and clinical significance were used to evaluate effectiveness. (Kuhn, 2009b)

Bae et al studied the Effect of motor control and strengthening exercises on pain, function, strength, and the range of motion of patients with shoulder impingement syndrome on 35 patients with shoulder impingement syndrome using VAS: Visual analog scale ERAP: Average power of external rotator IRAP: Average power of internal rotator and found that there is an effect in giving appropriate motor control training to patients with shoulder

impingement syndrome. It is assumed that there will be a need for more surveys on various variables for motor control training. (Bae et al. 2011)

Worsley et al. study the motor control retraining exercises for shoulder impingement: effects on function, muscle activation, and biomechanics in young adults. Shoulder function and pain were assessed using the Shoulder Pain and Disability Index (SPADI) and other questionnaires. Electromyography (EMG) and 3-dimensional motion analysis were used to record muscle activation and kinematic data during arm elevation to 90 and lowering in 3 planes. Patients were assessed pre and post a 10-week motor control-based intervention, utilizing scapular orientation retraining, and found that A 10-week motor control intervention for shoulder impingement increased function and reduced pain. Recovery mechanisms were indicated by changes in muscle recruitment and scapular kinematics. (Worsley et al., 2013)

Shire et al., have applied a systematic review and meta-analysis to determine whether using certain exercise plans incorporating resistive exercises is more efficient than a generic exercise approach, 6 randomized control trials were included, and this study found that the usefulness of certain resistive exercise regimens in the treatment of subacromial impingement syndrome is not sufficiently established to support or deny it. (Shire et al., 2017)

To reduce shoulder discomfort and improve function in RC tendinopathy, it is important to evaluate and compare the efficiency of various intervention methods that are solely focused on physical exercise muscle-development programs, so a systematic review has been adopted to evaluate and compare the efficacy of various therapeutic modalities based only on physical exercise muscle-development programs to alleviate shoulder pain and function in RC tendinopathy, and result that all exercise regimens were successful in treating RC tendinopathy, reducing discomfort and improving shoulder function. Due to the variety of the therapies, no conclusive conclusions could be drawn when they were compared. The most popular instruments for gauging patients' perceptions were utilized. Consideration should be given to the load level.(Dominguez-Romero et al., 2021)

Mertens et al., in their systematic review and meta-analysis, have studied the effectiveness of exercise therapy alone or in conjunction with other therapies in comparison to programs that only include exercises or do not include exercises, and also study the type of exercise training or combination with other interventions that are most successful, 33 studies were included in qualitative and 19 in the meta-analysis, the result of these studies Assumption that both programs including exercises and purely exercises increase ROM, function, and pain; however, there was little or no difference among programs for ROM and pain, and the evidence for a function was conflicting. When compared to a program without exercises, adding exercises enhances active ROM; however, adding physical methods has no positive impact. Compared to other forms of exercise, muscle energy methods are a helpful kind of exercise treatment for enhancing function. Regrettably, no conclusions can be made regarding the outcomes of the most potent and long-lasting exercise therapy regimen. (Mertens et al., 2022)

## **3. Chapter Three Methods and Materials**

### **3.1 Introduction.**

### **3.2 Research settings.**

### **3.3 Pilot study.**

### **3.4 Study methodology**

#### **3.4.1 Study design**

#### **3.4.2 Tools of data collection**

#### **3.4.3 Data collection procedure**

#### **3.4.4 Intervention program**

### **3.5 Sampling and Data Population.**

#### **3.5.1 Sampling Method**

#### **3.5.2 Sampling Size**

#### **3.5.3 Inclusion Criteria**

#### **3.5.4 Exclusion Criteria**

### **3.6 Ethical considerations.**

### **3.7 Statistical analysis.**

### **3.1 Introduction**

This chapter presents the sampling method, sample size, inclusion, and exclusion criteria, besides the methodology of the research represented in the design, tools of data collection procedure, intervention, and statistical analysis in addition to the ethical considerations of this research.

### **3.2 Research Setting**

The study was carried out at the Alia Governmental Hospital in Hebron's outpatient physiotherapy department. This is a government hospital located in the Palestinian West Bank city of Hebron. The Palestinian Ministry of Health oversees the management of Alia Hospital. When it was built in 1957, it had 237 beds. Among its 596 workers are radiologists, lab technicians, nurses, pharmacists, physiotherapists, and physicians, among others.

### **3.3 Pilot Study**

A pilot study was conducted on 5 patients to verify the smooth application of the assessment and the intervention procedures; the results of those pilot study participants weren't included in the statistical analysis of the study.

### **3.4 Methodology**

#### **3.4.1 Study Design**

An experimental comparative study was adopted for this study, as it is the best design that answered the questions of this study, with the least bias.

#### **3.4.2 Study Tools**

##### **3.4.2.1 Data collections sheet (Appendix 1)**

A data-collecting sheet with the following information:

- Demographic and Personal data: age, gender, socioeconomic status, occupation, and educational level.
- BMI.
- Diagnosis and Stage of Pain.
- Previous comorbidities.

### 3.4.3 Outcome Measures

The researcher assessed rotator cuff impairment by special tests:

#### 3.4.3.1 Goniometer

Shoulder range of motion was examined by using the Goniometry application on an Apple iPhone 14 pro smartphone a photo-based Goniometer is used to measure the joints' angular range of motion that's provide to conduct a baseline evaluation to track patients' rehabilitation progress and advancement. Shoulder range of motion was assessed according to **Table (3-1)**. When compared to a standard goniometer, this instrument is valid (0.80 ) and reliable ( 0.82). (Mitchell et al., 2014)

Table 3-1Shoulder Range of Motion assessment

<b>Movement</b>	<b>Patient Position</b>	<b>Goniometer Placement</b>	<b>Special Instructions</b>
<b>Flexion</b>	Sitting upright or standing, arms relaxed at the sides	<b>Axis:</b> At or just below the tip of the acromion. <b>Fixed Arm:</b> Aligned with the midline of the body. <b>Movable Arm:</b> Along the shaft of the humerus.	The patient must keep the arm straight.
<b>Extension</b>	Sitting upright or standing, arms relaxed at the sides	<b>Axis:</b> At or just below the tip of the acromion. <b>Fixed Arm:</b> Aligned with midline of the body. <b>Movable Arm:</b> Along the shaft of the humerus.	The patient must keep the arm straight.
<b>Abduction</b>	Sitting upright or standing, arms relaxed at the sides	<b>Axis:</b> Posterior acromion process <b>Fixed Arm:</b> parallel	The patient must keep the arm straight.

		with the trunk Pointed at the floor <b>Movable Arm:</b> Along the shaft of the lateral humerus	
<b>Internal rotation</b>	Supine, elbow bent 90 degrees at the edge of a table , thumb up	<b>Axis:</b> Olecranon process of the ulna <b>Fixed Arm:</b> Aligned with the midline of the body <b>Movable Arm:</b> in line with the ulnar side of the forearm from the axis point to the ulnar styloid process	The patient-test side must be supported on with a thin pillow to keep the forearm is in a neutral position
<b>External rotation</b>	Sitting upright, elbow bent 90 degrees, thumb up	<b>Axis:</b> Olecranon process of the ulna <b>Fixed Arm:</b> Aligned with the midline of the body <b>Movable Arm:</b> in line with the ulnar side of the forearm from the axis point to the ulnar styloid process	Patient-test side must be supported the with a thin pillow to keep the forearm is in a neutral position

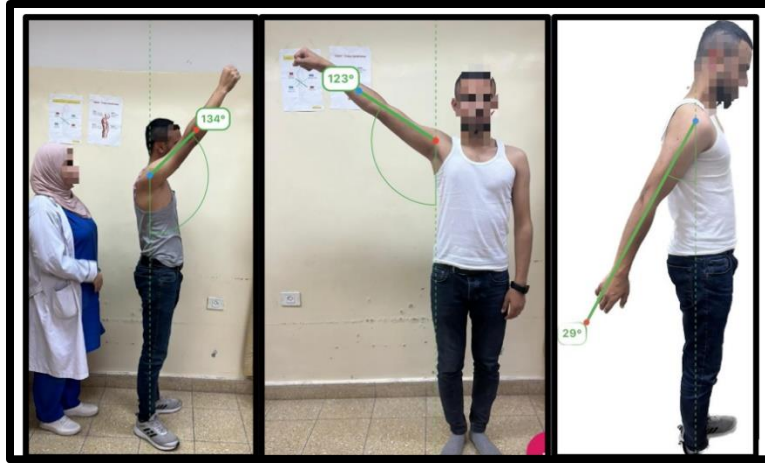


Figure 3-1 Active Range of Motion for Shoulder

### 3.4.3.2 Movement Control test

The Movement Control Test also called Cognitive Movement-test a novel method that evaluates a person's capacity for shoulder movement with appropriate stability, control, and synchronization. This test for low back pain is reliable and valid. (Luomajoki et al., 2008).

Administered with the patient in a supine, standing, or sitting position, depending on the movement we test. We asked the patient to settle in, and then we gave a brief explanation of the test's goal and the particular movement we would be evaluating. To ensure that the patient understood, we also showed them how to move their shoulders correctly. Request that the patient raise their arm as high as is comfortable without hurting them. While acting, pay attention to the following: the movement's smoothness; any compensatory movements or substitutes; the left and right sides' symmetry; the stability of the scapula (shoulder blade); and discomfort or pain experienced when moving, A patient may have adequate movement

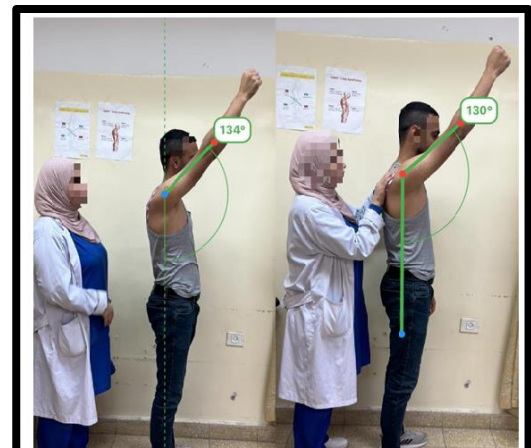


Figure 3-2 Movement Control test for shoulder Flexion



Figure 3-3 Movement Control test for shoulder Abduction

control if they can execute the movement painlessly and with no compensations. During the exam, compensatory movements, asymmetry, or discomfort.(Comerford & Mottram, 2012)

### 3.4.3.3 Static Muscle Strength

A popular technique for manual muscle assessment is the Oxford Scale, often called the Oxford Muscle Grading System. This qualitative scale uses an individual's subjective assessment of the muscle's reaction to resistance to determine how strong the muscle is, each movement was assessed with instruction at table (3-2) below. Every grade on the Oxford Scale, which goes from 0 to 5, corresponds to a distinct degree of muscular strength:

**0:** No visible contraction.

**1:** Visible palpation contraction.

**2:** Limb move with gravity elimination.

**3:** Limb move against gravity resistance.

**4:** The limb moves against gravity resistance with minimal resistance.

**5:** The limb moves against gravity resistance with maximal resistance.

Oxford scale is a valid and reliable Intraclass Correlational Coefficient (ICC) = (0.92-0.97)(Cuthbert & Goodheart, 2007)



Figure 3-4 Manual Muscle Testing For Shoulder Movement

Table 3-2 Shoulder Muscle Power Assessment

<b>Movement</b>	<b>Muscle(s) Tested</b>	<b>Patient Position</b>	<b>Therapist Position</b>	<b>Test Procedure</b>
<b>Flexion</b>	Deltoid (anterior & medial fibers), pectoralis major	Sitting upright, arm relaxed at the side	Stand behind the patient, stabilize the scapula	Ask the patient to raise the arm forward overhead against resistance applied at the elbow
<b>Extension</b>	Deltoid (posterior fibers), latissimus dorsi	Sitting upright, arm hanging off the edge of the table	Stand behind the patient, stabilize the scapula	Ask the patient to push their arm back against resistance applied at the elbow
<b>Abduction</b>	Deltoid (medial & lateral fibers), supraspinatus	Sitting upright, arm relaxed at the side	Stand behind the patient, stabilize the scapula	Ask the patient to raise the arm out to the side against resistance applied at the humerus
<b>Internal Rotation</b>	Subscapularis, pectoralis major	supine, elbow bent 90° with thumb pointing up	Stand behind the patient, stabilize the scapula	Ask the patient to turn the palm inwards towards the chest against resistance applied at the forearm
<b>External Rotation</b>	Infraspinatus, teres minor	Supine, elbow bent 90° with the thumb pointing up	Stand behind the patient, stabilize the scapula	Ask the patient to turn palm outwards away from the body against resistance applied at the forearm

### 3.4.3.4 Orthopedic Tests

#### Neer's impingement sign

Neer's impingement sign investigates the syndrome of subacromial impingement. The procedure is based on the examiner stabilizing the patient's scapula with one hand while passively flexing the arm when it is internally rotated. This test is considered positive if the patient experiences discomfort and pain in this position. Neer's test has a sensitivity of 59-72% and a specificity of 6%. (Macdonald et al., 2000)



Figure 3-5 Neer's impingement sign

#### Hawkins–Kennedy test

The Hawkins-Kennedy test evaluates subacromial impingement syndrome. The method of application relies on the examiner taking the shoulder to a 90° abduction in the scapular plane while concurrently flexing the elbow to a 90° angle. The humerus is internally rotated slowly and as much as possible from this position; a positive test result is obtained if the patient experiences discomfort during internal rotation. Hawkins-Kennedy test has a sensitivity of 58-80% and a specificity of 56-67%. (Macdonald et al., 2000)



Figure 3-6 Hawkins–Kennedy test

#### Painful Arc Sign

A painful arc test is used to evaluate the syndrome of subacromial impingement. The method is predicated on the patient having to be seated or standing, and the examiner asked him to abduct his arm and shoulder simultaneously. If the patient experiences discomfort, we ask him to go to the end of the range. When a patient feels discomfort between 60 and 120 degrees of abduction, which lessens after 120 degrees of abduction, the test is considered

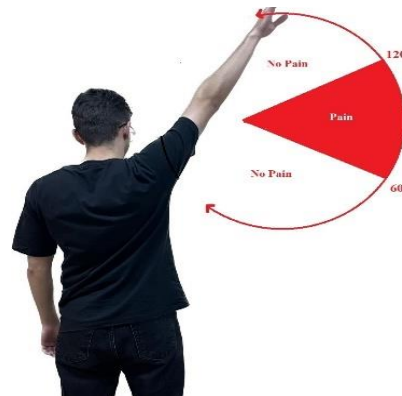


Figure 3-7 Painful Arc Test

positive. The painful arch test has a Sensitivity of 0.33 and a Specificity of 0.81(Park et al., 2005)

### Empty Can Test

The Empty Can test raises the patient's arm to 90 degrees and completes internal rotation; the patient tries to resist the examiner's downward pressure while they assess the integrity of the supraspinatus tendon. Positive indicators taken into consideration if the patient feels weak or in pain when facing opposition. The empty can test exhibits 88.6% sensitivities and 58.8% specificities. (Kelly et al., 2010)



Figure 3-8 Empty Can Test

### Full Can Test

The Full Can Test evaluates the supraspinatus impingement by raising the patient's arm to 90 degrees and performing a full external rotation. The patient attempts to resist the examiner's downward pressure, and the test is deemed successful if the patient feels pain or weakness in response. Empty can test has a sensitivity of 70% and a specificity of 81%.



Figure 3-9 Full Can Test

### 3.4.3.5 Scapular Clinical Static Test

#### Distance between the medial scapular border and T4

Starting with the examination of the medial scapular boundary and the fourth thoracic spinous process (T4), the examiner measures the distance while the patient is standing. A 1.5 cm side-to-side fluctuation can be used to detect shoulder dysfunction, according to studies. The tape measure is used to measure the distance between the two anatomical landmarks of each patient's scapula and compare the variances, the reliability of this test is 0.50-0.79 (Struyf, Nijs, et al., 2014).



Figure 3-10 Distance between medial scapular boarder and T4

#### Distance between Acromion and Table

The patient was instructed to lie down and rest. The examination continues with the examiner palpating the posterior acromion process, measuring the bilateral vertical space between the acromion border and the bed using a tape measure, and comparing the results. The test reliability is 0.88-0.94(Struyf, Nijs, et al., 2014)



Figure 3-11 Distance between Acromion and Table

#### 3.4.3.6 Numeric Rating Scale (NRS) (Appendix 2)

The numeric Rating scale is a tool for a subjective rating of pain, patients are asked to indicate their pain intensity from 0 (no pain at all) to 10 the worst pain. (Williamson & Hoggart, 2005) The patient will be asked to mark a number on the line that indicates their pain It is a simple method to determine the severity of pain according to the patient's perception, and easy to see the changes in values, later on, NRS is reliable and valid for pain assessment( $r=0.74$ ). (Mintken et al., 2009)

Numeric Rating Scale (NRS)

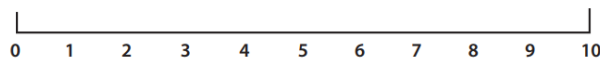


Figure 3-12 Numeric Rating scale

#### 3.4.3.7 Quick DASH Questionnaire (Appendix 3)

Quick DASH Questionnaire is a self-reported questionnaire used to measure the physical function of patients with musculoskeletal disorders of the upper extremities. consist of instead of 30 items, their item used to assess the functional ability of the patient to do upper extremity activity through 5-point Likert scale items, a higher scores indicate a greater level of disability and severity The Scoring Formula of this outcome is calculated by the sum of **n** response dividing by **n** Subtract from it **1** and then multiply by **25**, where n is the total number of completed

items, also its translated to Arabic Quick DASH is valid and reliable (r=0.90)(Gambeson et al., 2006).

#### 3.4.3.8 Western Ontario Rotator Cuff Index (WORC) (Appendix 4)

WORC Index is a patient-reported outcome measure specifically designed for assessing the quality of life and function in individuals with rotator cuff disorders. affect physical ability, sports, recreation, work, social life, and emotions. The linear distance along the line that runs from left to right is measured for WORC scoring. The scoring of WORC depends on measuring the linear distance from left to right, along the line using (VAS), which is a straight line that represents a 100-point scale with a range of 0-100, is used for each inquiry.

Some small arithmetic is done to make the final result more scientifically acceptable. After deducting 2100 from the overall number, dividing by 2100, and multiplying by 100, the score is expressed as a percentage. For example: if the total score is 1655 then the subtraction would be (2100-1655 =445) then divided by the maximum possible score (2100) and multiplied by 100

$$\text{Total Score} = (445/2100) \times 100 = 21.19\%$$

Therefore, the total final WORC scores might vary from 0%, which represents the **lowest** functional status level, to 100%, which represents the **greatest** functional status. This outcome reliable and has an excellent test-retest reliability of 0.85-0.99. (El et al., 2006)

#### 3.4.4 Data Collection Procedures

The study was approved ethically by the Al-Quds University central ethical committee following a discussion with the physiotherapy department's higher education committee. (Appendix 9). After contacting the Palestinian Ministry of Health, consent was given. Following the identification of patients and potential participants from the orthopedic referrals, a screening phase for inclusion and exclusion criteria commenced. During a meeting in the physiotherapy department, patients who met the inclusion for the research were asked to participate and were encouraged to do so.

Patients were randomly assigned to one of two groups: (20 patients, both male and female) participated in the Muscle-Imbalance Based Exercise Group; (20 patients, both male and female) participated in the Kinetic Control Program Group.

Patients who agreed to participate were enrolled randomly in the trial after being informed about its purpose and intervention approach through an information sheet (appendix 10). Participants completed a written permission form (Appendix 11) before the intervention taking place. Patients were randomly assigned to one of two groups: (20 patients, both male and female) participated in the Muscle-Imbalance Based Exercise Group; (20 patients, both male and female) participated in the Kinetic Control Program Group. subsequently, a baseline evaluation was completed using the previously mentioned tests, and data collecting sheet, and the outcomes were noted. Following the three sessions weekly of treatment each group was assigned until the patient was follow-up, posttests were conducted using the identical outcome measures and assessments as the baseline examinations.

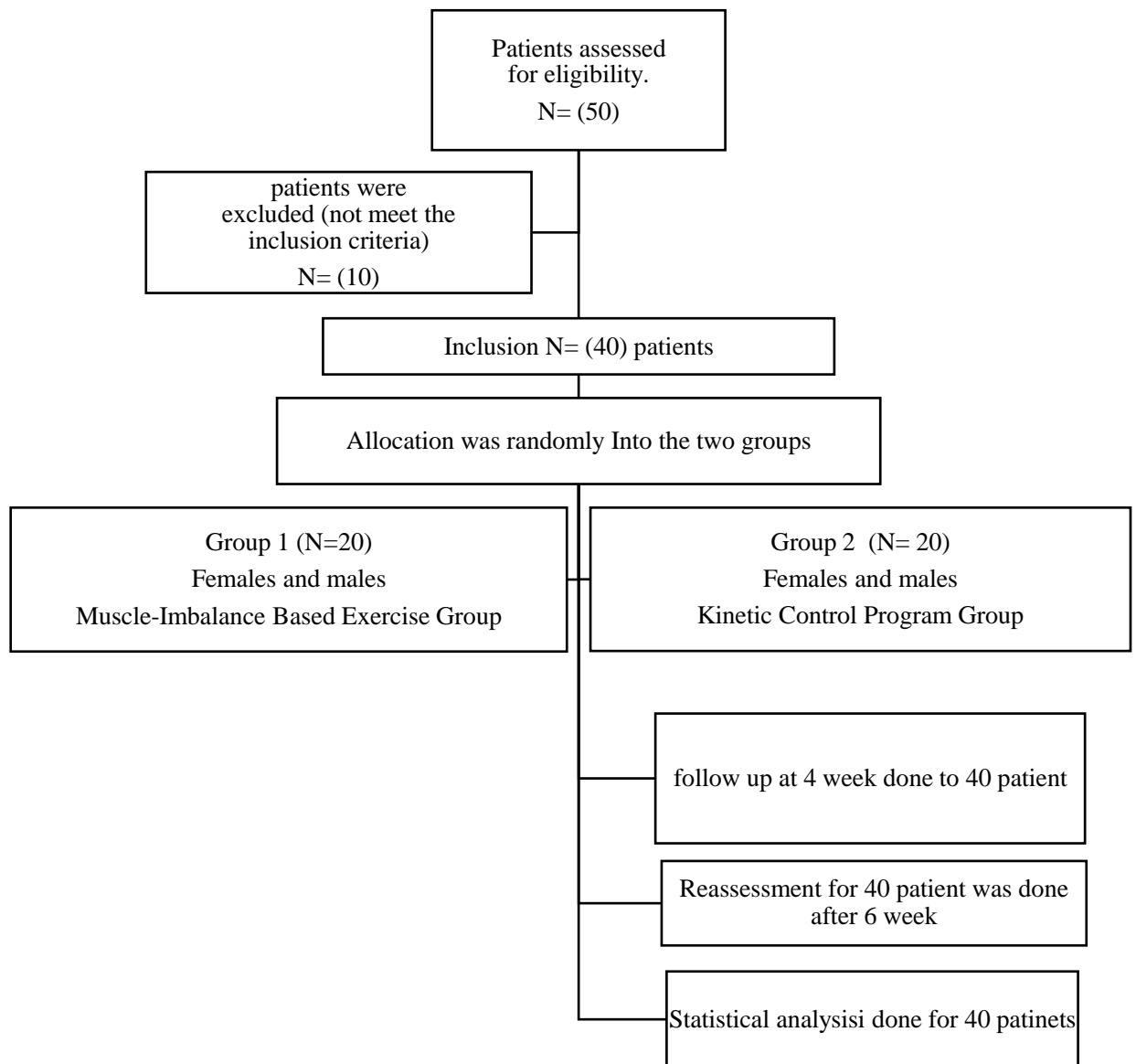


Figure 3-13 Flow chart of the participants

### 3.4.5 Intervention Procedures

The participants in each group had 3 sessions per week for a total of 12 sessions spread over 6 weeks. Each intervention session lasted between 30-45 minutes.

#### 3.4.5.1 Muscle-Imbalance-Based exercise Group (Appendix 5)

Participants of this group received different types of therapeutic exercises that included: **Warm-up** before doing the exercises, and warm up with 5 to 10 minutes of low impact activity, like walking or riding a stationary bicycle. **Strengthening** exercise to strength the muscle around the shoulder, maintain stability, relief pain and prevent further injury. Also, **Flexibility** training to restoring range of motion and avoiding injury. **Cool down** after exercise 5-10.

	Sat	Sun	Mon	Tues	Wed	Thru
<b>Warm-up</b>		10 min		10 min		10 min
<b>Major training</b>		20 min		20 min		20 min
<b>cool down.</b>		10 min		10 min		10 min

#### Progression Strategies

- Changing between the 3 colors of the TheraBand as tolerated
- Changing the weight of the Dumbbells as tolerated
- Increasing the repetitions from 10, 15, 20 as tolerated
- Increasing the number of bouts 2, 3 as tolerated

#### 3.4.5.2 Kinetic control program group (Appendix 7)

##### **Motor control progression Suggested for kinetic control program**

1. Tactile feedback
2. Verbal feedback
3. Visual feedback (mirror)
4. Proprioceptive intrinsic feedback

## **Instructions**

1. Perform the exercise while keeping neutral position
2. The exercise should be performed up the limit where the participant had lost the neutral position in the cognitive movement-test
3. The 2 minutes will be divided as 15 repetition maximum during each 30 seconds or when the patient feels fatigue where he should stop
4. Then the patient should start the new bout of exercising in the following motor control stage (tactile → verbal → visual → internist)
5. Each time the patient comes, new cognitive movement-test will be performed, to adopt the new ROM for this particular Movement kinetic control program.

## **3.5 Sampling and Population**

### **3.5.1 Sampling Method**

The sample was recruited based on a convenient sampling method, It is described as a non-probability sampling technique in which participants are chosen for the sample based on who is most convenient for the researcher to contact. This may be the result of factors including close proximity to one another, availability at a specific moment, or desire to take part in the study.(Sedgwick, 2013)

The allocation to either group (muscle imbalance group and kinetic control group) was based upon random allocation based on the codes from 1-40, where the excel software was used to generate the codes related to either group

### **3.5.2 Sample Size**

All the patients who were referred to the outpatient clinic in Alia Hospital from the date 1-03-2023 to 1-07-2023 and met inclusion criteria were included .The study included 40 patients (20 in either group) with Rotator cuff dysfunction, this sample size was based on a minimum requirement of intended statistical analysis (paired sample t-test within the group, and independent sample t-test for in between the groups at T1 and T2).

### **3.5.3 Inclusion Criteria**

In this study, participants were considered if they were:

- Rotator Cuff Dysfunction patients treated at the outpatient Department in Hebron Governmental Hospital.
- Male & female.
- Age 40-60 years.
- Has a referral from a doctor with diagnosis of rotator cuff tendinopathy, dysfunction, tendonitis, or partial tear less than 50 %. (Confirmed by an MRI/US report)

### **3.5.4 Exclusion Criteria**

- A patient who declines to fill out a consent form.
- Skin erythema, edema, or deformity that is not explained.
- Considerable weakness that is not caused by pain (neural testing +).
- A history of cancer in the past or a suspected cancer (such as weight loss or appetite loss).
- Patients reporting fever, chills, or malaise.
- Notable unaccounted-for sensory/motor deficiencies.
- Vascular or pulmonary impairment.
- Patient with >50% tear in their rotator cuff.
- Individuals who have shoulder surgery during the last six months.
- Patients on pain medications

### **3.6 Ethical Consideration**

Information regarding the study's objectives, methods, possible weariness, and lowest risks was given orally and in writing to each participant (Appendix 10). Their safety was given careful consideration over the whole trial, and they deliberately chose to participate.

A formal informed consent form in Arabic was also signed by each participant prior to their enrollment in the research (Appendix 11). Before the study began, administrative clearance was received from the Al-Quds University ethics committee and the Palestinian Ministry of Health. (Appendix 9)

Every patient received a guarantee of secrecy and anonymity. They were informed of their right to leave the research at any time without suffering consequences to their interests. Codes were used instead of names for data analysis, and the chief investigator will be in charge of keeping the data secured in a secure location that is inaccessible. The study's participants will have access to and receive the outcomes of the investigation.

### **3.7 Statistical Analysis**

SPSS version 26 was used for the statistical analysis of the data. The mean and standard deviation were shown for independent variables such as age, height, weight, and BMI. The nominal factors in both groups were shown as frequencies and percentages in tables and bar charts, including gender, diabetes history, and smoking status. Normality Shapiro-Wilk test (participants was 40), Independent sample t-test and paired sample t-test, two related sample, and logistic binary regression, were used to test the study hypothesis. When data was not normal, the Mann Whitney non-parametric test was performed to examine the significance of the difference of the posttests between groups, while Wilcoxon test was used to investigate the difference between pre and posttests within groups.

## **4. Chapter Four Result Presentation, Analysis and Discussion**

### **4.1 Descriptive Statistics of Variable**

### **4.2 Normal Distribution of the Parametric Data**

### **4.3 Inferential Statistical Analysis of Tested Variable**

### **4.4 Differences of Mean Between Two Groups at Baseline of all Research Variable**

### **4.5 Differences in Mean Between Two Groups in all Research Variable Improvement**

### **4.6 Multi variate analysis (regression) for predictors of improvement**

### **4.7 Discussion**

### **4.8 Study Limitations**

## 4.1 Descriptive Statistics of variables

### 4.1.1 Age of Participants.

The mean age of all participants in the study was  $42.05 \pm 5.4$ . The average ages of the participants of the Kinetic control group were  $42.55 \pm 4.8$ , whereas the average age of the muscle-imbalance exercise group was  $41.55 \pm 6$ . (Figure 4.1).

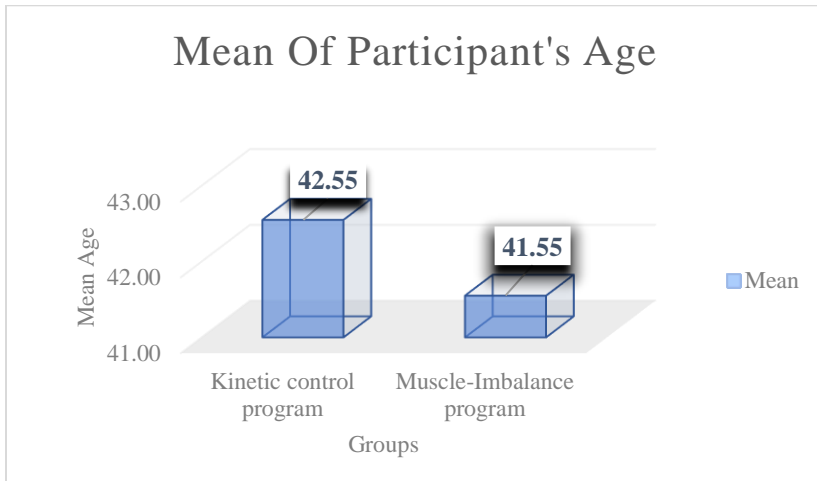


Figure 4-1 Mean Age of the Participants

### 4.1.2 Gender of Participants.

The study sample was split into two groups, each Group had 20 participants. kinetic Control program included (7), 35% Males, and (13), 65 % Females, also. The muscle-imbalance program included (5), 25% Males, and (15), 75% Females (Figure 4.2).

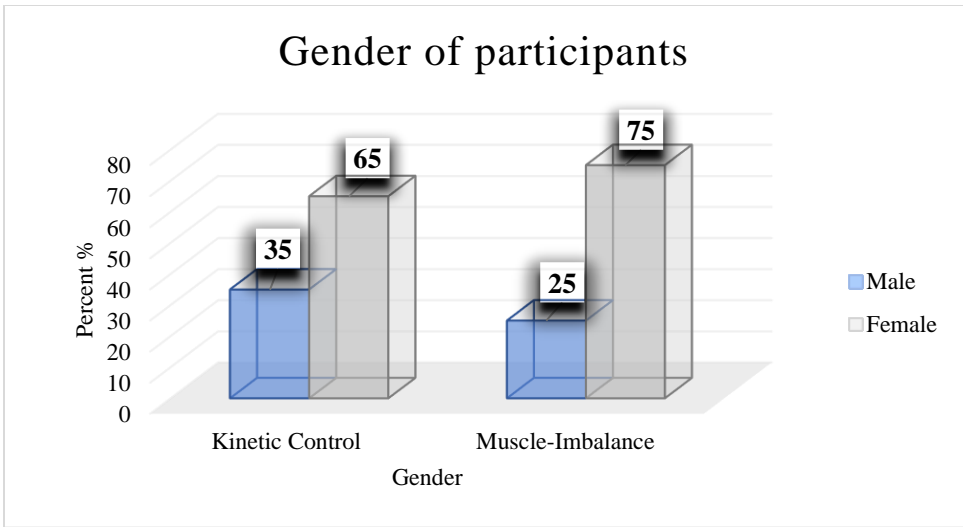


Figure 4-2 Gender of Participants

#### 4.1.3 Diagnosis of the Participant.

Regarding the diagnosis of the participant, in the kinetic control group, the distribution was: **13 (65%)** participants had Rotator Cuff Tendinitis, **3(15%)** had Rotator Cuff Tendinopathy, **4(20%)** had impingement syndrome, while in the muscle-imbalance group, **9(45%)** participants had Rotator Cuff Tendinitis, **4(20%)** were Rotator Cuff Tendinopathy, and **7(35%)** were impingement syndrome (**Figure 4-3**)

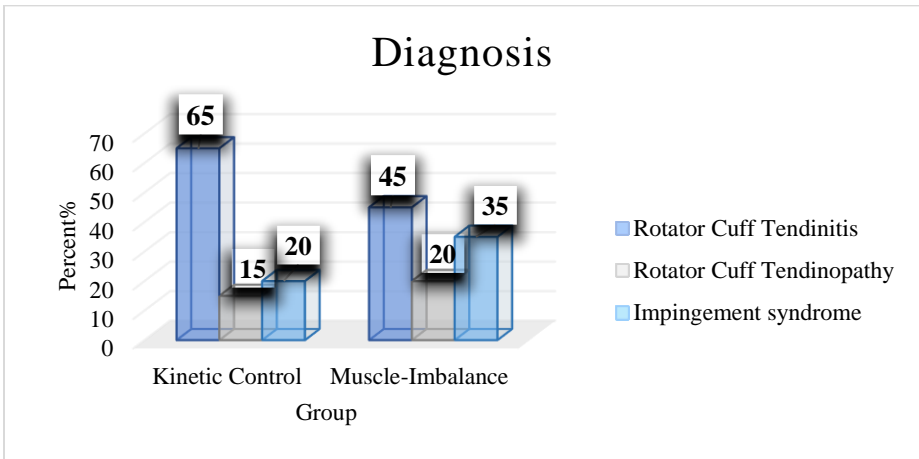


Figure 4-3 Diagnosis of the Participant

#### 4.1.4 BMI of Participants.

The body mass index (BMI) mean was 28.08 for the kinetic control program group, compared to 28.03 for the muscle-imbalance program group. (Figure 4-4).

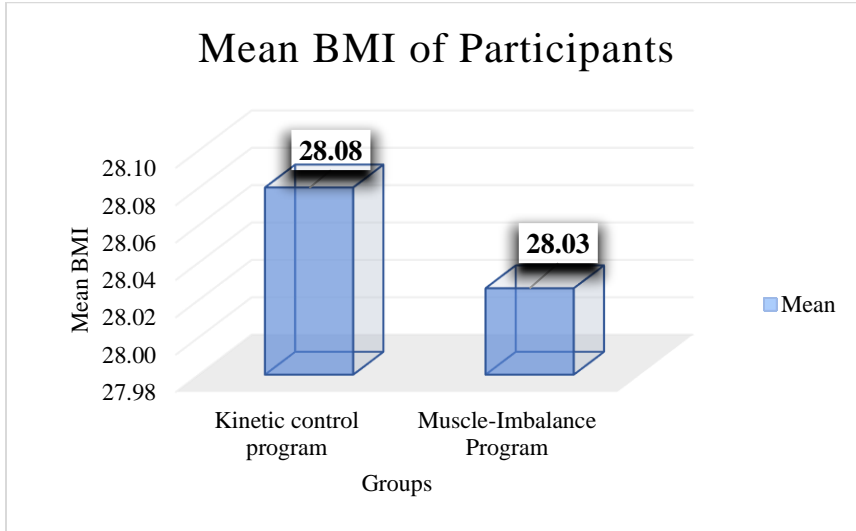


Figure 4-4 BMI of Participant

Regarding BMI Categorization of the Participants, in the kinetic control group, the distribution was: **7(35%)** participants had normal weight, **7(35%)** were pre-obesity, **7(35%)** were Obese class 1, and **2(10%)** were obese class is obese class II, while in the muscle-imbalance group, **5(25%)** participants had normal weight, **11(55%)** were pre-obesity, **3(15%)** were Obese class 1, and **1(5%)** were obese class is obese class II (Figure 4-5).

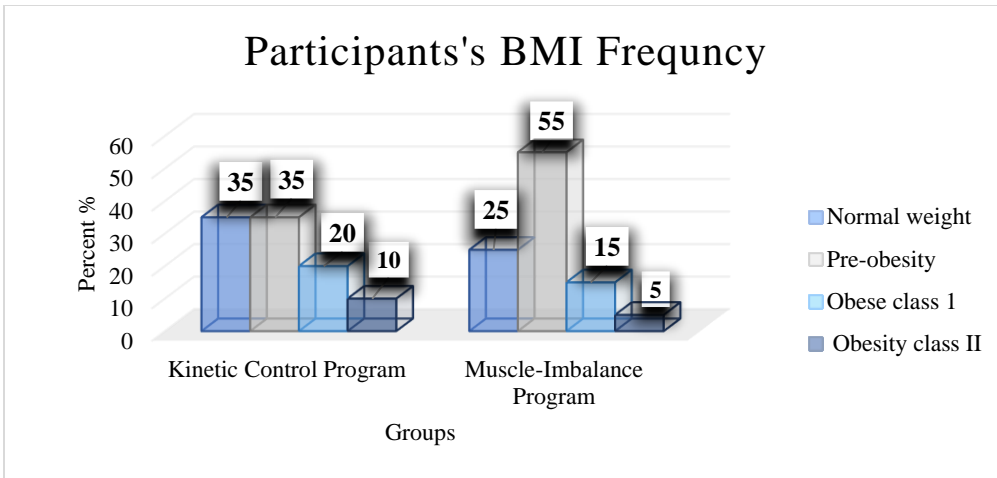


Figure 4-5 BMI Categories of the Participants

#### 4.1.5 Occupation of the Participants

Regarding Occupation of the Participants, in the kinetic control group, the distribution was: **7(35 %)** participants are office workers, **9(45 %)** have physical demand jobs, and **4(20 %)** don't have an occupation, on the other hand, muscle-imbalance group have, **4(20%)** participants were office worker, **7(35%)** are physical demand Jobs, and **9(45%)** don't have an occupation. **(Figure 4-7).**

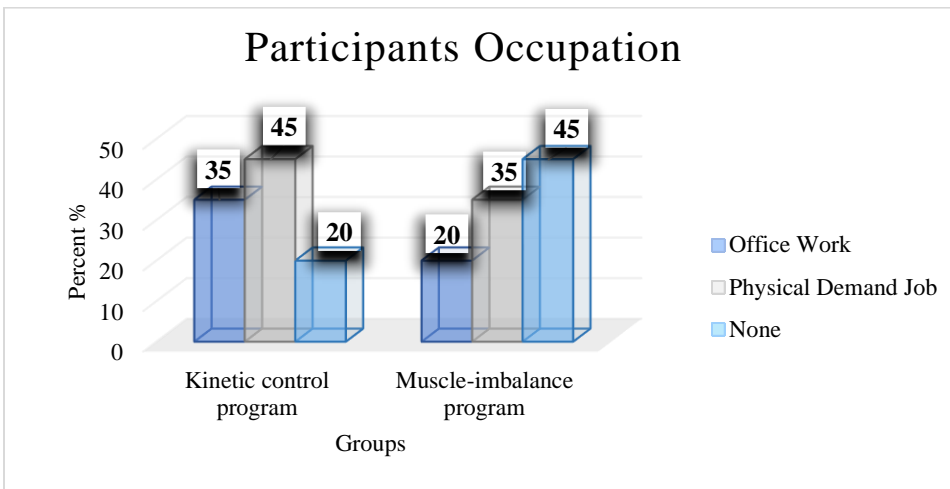


Figure 4-6 The Participant's Occupation

#### 4.1.6 History of Smoking

In the kinetic control group, **4 (20%)** of the participants were smokers, and **16(80%)** were non-smokers, while in the muscle-imbalance group, the distribution was **5(25%)** were smokers, and **15(75%)** were non-smokers. (**Figure 4-7**).

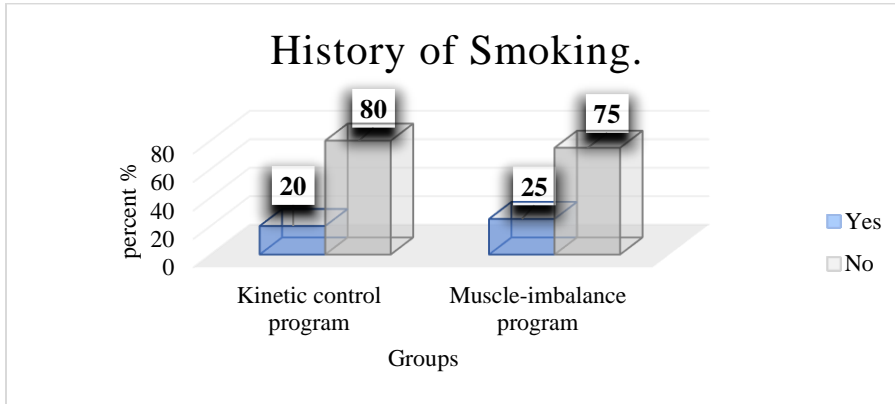


Figure 4-7 Smoking History

#### 4.1.7 History of Diabetes

In the kinetic control group, **4 (20%)** of the participants had diabetes, while **16 (80%)** did not, whereas in the muscle-imbalance group, **2 (10%)** of the participants had diabetes, while **18 (90%)** did not. (**Figure 4-8**).

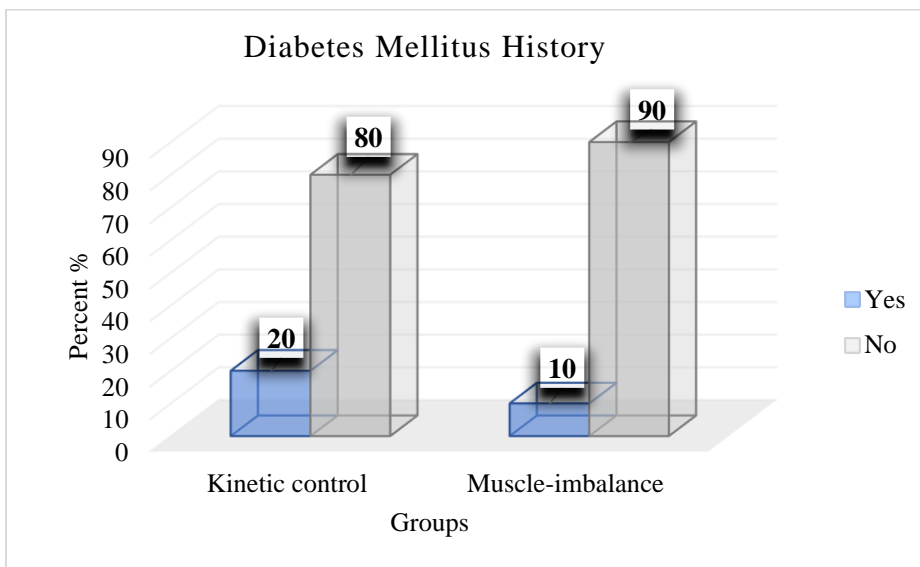


Figure 4-8 History of Diabetes

## 4.2 Normal distribution of the parametric data

### Normality Shapiro-Wilk testing for parametric data

Before beginning the data analysis, the normality of study variables between the study groups (kinetic control and muscle imbalance) was assessed. This was accomplished by using the Shapiro-Wilk the results are shown in the following table (**Table 4-1**).

Table 4-1 Normality Test

	Shapiro-Wilk		
	Statistic	df	Sig.
CMT Flexion T1	0.958	40	0.148
CMT Flexion T2	0.953	40	0.096
Flexion T1	0.970	40	0.347
Flexion T2	0.954	40	0.107
CMT Abduction T1	0.946	40	0.056
CMT Abduction T2	0.963	40	0.213
Abduction T1	0.951	40	0.083
Abduction T2	0.952	40	0.091
CMT extension T1	0.952	40	0.086
CMT extension T2	0.951	40	0.081
Extension T1	0.932	40	0.019
Extension T2	0.919	40	0.007
CMT Medial Rotation T1	0.964	40	0.228
CMT Medial Rotation T2	0.958	40	0.145
Medial Rotation T1	0.947	40	0.059
Medial Rotation T2	0.961	40	0.182
CMT lateral rotation T1	0.959	40	0.154
CMT lateral rotation T2	0.951	40	0.081
Lateral rotation T1	0.946	40	0.056
Lateral rotation T2	0.950	40	0.077
Distance of Scapula from spine middle angle T1	0.954	40	0.104
Distance of Scapula from spine middle angle T2	0.965	40	0.247
Distance acromion from bed T1	0.949	40	0.071
Distance acromion from bed T2	.956	40	.123
Quick DASH Questionnaire at T1	0.956	40	0.122
Quick DASH Questionnaire T 2	0.965	40	0.240
Western Ontario Rotator Cuff Index (WORC) at T1	0.945	40	0.051
Western Ontario Rotator Cuff Index (WORC) T 2	0.975	40	0.501
Numeric Rating Scale at T1	0.960	40	0.166
Numeric Rating Scale T 2	0.946	40	0.053

Improvement flexion	0.951	40	0.079
Improvement CMT flexion	0.950	40	0.078
Improvement abduction	0.949	40	0.068
Improvement CMT abduction	0.950	40	0.078
Improvement extension	0.949	40	0.073
Improvement CMT extension	0.949	40	0.070
Improvement medial rotation	0.958	40	0.144
Improvement in CMT medial rotation	0.959	40	0.157
Improvement lateral rotation	0.965	40	0.243
Improvement in CMT lateral rotation	0.967	40	0.291
Improvement in the distance of the scapula from the spine middle angle	0.949	40	0.068
Improvement in distance acromion from bed	.949	40	.072
Improvement in QDASH	0.937	40	0.028
Improvement in WORC	0.965	40	0.248
Improvement in NRS	0.945	40	0.050

### 4.3 Inferential statistical analysis of the tested variables.

#### 4.3.1 Static Muscle Strength

Table illustrates the frequency of manual muscle testing percentage of the patient in T1 and T2 3 represent Limb move against gravity resistance, 4 mean that Limb moves against gravity resistance with minimal resistance and 5 Limb move against gravity resistance with maximal resistance. (Table 4-2)

Table 4-2 Distribution of Static Muscle Strength By Grade Between the Groups

Shoulder Joint movements	Kinetic control program			Muscle imbalance		
	MMT scores			MMT scores		
Test	3(%)	4(%)	5 (%)	3(%)	4(%)	5 (%)
MMT Flexion T1	35	60	5	50	40	10
MMT Flexion T2	0	70	30	0	40	60
MMT Abduction T1	30	55	15	25	70	5
MMT Abduction T2	5	55	40	5	20	75
MMT Extension T1	30	65	5	20	55	25
MMT Extension T2	0	45	55	0	25	75
MMT Medial Rotation T1	40	60	0	50	50	0
MMT Medial Rotation T2	5	75	20	0	30	70
MMT Lateral Rotation T1	50	50	0	30	70	0
MMT Lateral Rotation T2	10	70	20	0	5	95

#### 4.3.1.1 Improvement of oxford within groups

As presented in **Table 4-3** all the directions of movement static muscle strength were improved from baseline T1 to follow-up at T2 (Table 4-3)

Table 4-3 Statistical results of Wilcoxon Signed Ranks Test for Testing Improvement of Static Muscle Strength within the Groups between T1 and T2

Patient Group		Mean T1	Mean T2	Z-Score	Sig.
Kinetic control program	MMT flexion	3.7	4.3	-3.464 <sup>b</sup>	0.001
	MMT Abduction	3.8	4.35	-3.051 <sup>b</sup>	0.002
	MMT Extension	3.75	4.55	-4.000 <sup>b</sup>	0.00
	MMT Medial Rotation	3.6	4.15	-3.317 <sup>b</sup>	0.001
	MMT Lateral Rotation	3.5	4.1	-3.464 <sup>b</sup>	0.001
Muscle-imbalance program	MMT flexion	3.6	4.6	-4.066 <sup>b</sup>	0.00
	MMT Abduction	3.8	4.7	-4.025 <sup>b</sup>	0.00
	MMT Extension	4.05	4.75	-3.500 <sup>b</sup>	0.00
	MMT Medial Rotation	3.5	4.7	-4.179 <sup>b</sup>	0.00
	MMT Lateral Rotation	3.7	4.95	-4.134 <sup>b</sup>	0.00

### 4.3.1.2 Static Muscle Strength between groups at follow up

As presented in Table 4-4 and Figure 4-9 there were statistically significant differences in muscle power associated with abduction, lateral and medial rotation ( $p < 0.05$ )

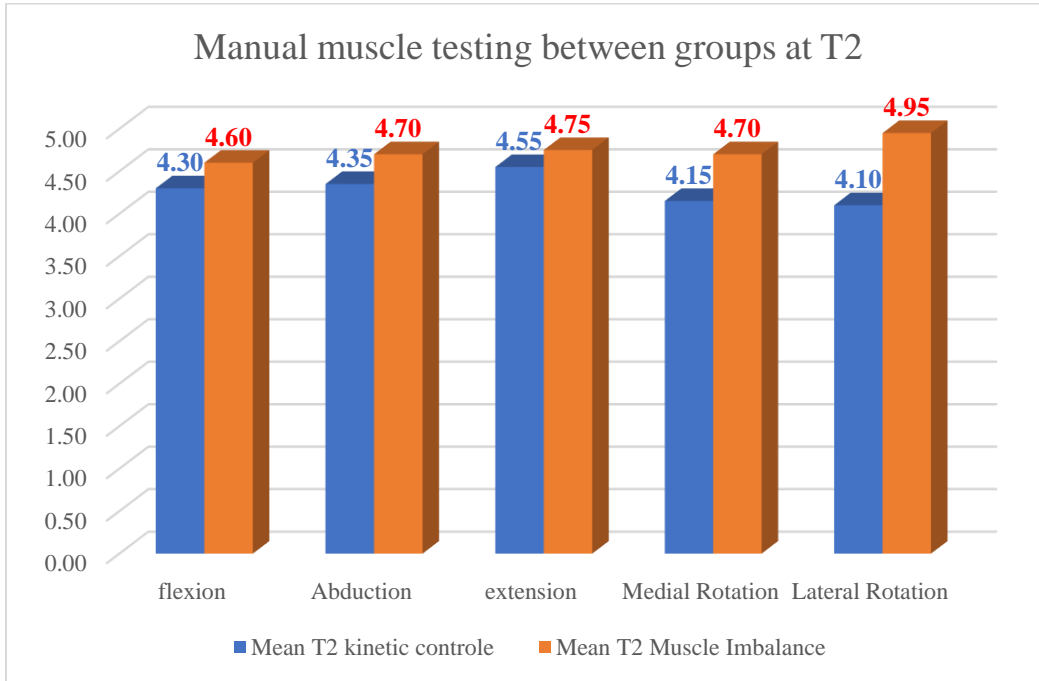


Figure 4-9 Variation of Mean T2 Between the Groups at follow up

Table 4-4 show the Statistical results of the Mann-Whitney U Test for Testing Mean Manual Muscle Testing at follow-up

Table 4-4 Difference of Mean Manual Muscle Testing at T2 Between Groups

	Mean T2 kinetic control	Mean T2 Muscle Imbalance	Z-Score	Sig.
<b>flexion</b>	<b>4.30</b>	<b>4.60</b>	<b>-1.883</b>	<b>.060</b>
<b>Abduction</b>	<b>4.35</b>	<b>4.70</b>	<b>-2.067</b>	<b>.039</b>
<b>extension</b>	<b>4.55</b>	<b>4.75</b>	<b>-1.309</b>	<b>.190</b>
<b>Medial Rotation</b>	<b>4.15</b>	<b>4.70</b>	<b>-3.186</b>	<b>.001</b>
<b>Lateral Rotation</b>	<b>4.10</b>	<b>4.95</b>	<b>-4.693</b>	<b>.000</b>

### 4.3.2 Range of Motion

#### 4.3.2.1 Differences of mean between two groups at baseline of all research variable

**Table 4-5** illustrates mean, standard deviation, paired-samples t-test value, and significance level (Sig.), the differences in means between two groups (the "Kinetic control program" and the "Muscle-imbalance program") for all research variables at baseline which summarize that there is no significant difference in (Flexion, CMT Flexion, Extension, Medial Rotation, Distance between the medial scapular border and T4, Distance between the acromion and bed, Numeric Rating Scale, Quick DASH, WORC) ( $p > 0.05$ ) while there is significant difference at baseline of **CMT abduction, Abduction, CMT Extension, CMT Medial Rotation, Lateral Rotation CMT Lateral Rotation ( $p < 0.05$ ).**

Table 4-5 Differences of mean between two groups at baseline of all research variable

Test	Kinetic control	Muscle-imbalance	Mean Difference	T-test	Sig. (2 tailed)
	Mean $\pm$ SD	Mean $\pm$ SD			
Flexion	161.95 $\pm$ 7.21	162.5 $\pm$ 6.74	-0.55	-0.25	0.80
CMT Flexion	151.35 $\pm$ 5.04	153.85 $\pm$ 6.01	-2.50	-1.43	0.16
Abduction	135.95 $\pm$ 12.62	149.15 $\pm$ 8.98	23.75	6.20	0.00
CMT Abduction	124.9 $\pm$ 14.01	136.25 $\pm$ 10.77	11.35	2.87	0.01
Extension	25.5 $\pm$ 6.66	27.75 $\pm$ 6.58	-1.95	-1.58	0.12
CMT Extension	22.85 $\pm$ 3.55	25.15 $\pm$ 14.01	-2.30	-1.94	0.06
Medial Rotation	50.65 $\pm$ 7.19	53.2 $\pm$ 6.83	-2.90	-1.32	0.19
CMT Medial Rotation	43.3 $\pm$ 7.19	46.9 $\pm$ 5.70	-3.60	-1.96	0.06
Lateral Rotation	53.85 $\pm$ 7.42	58.5 $\pm$ 5.71	-4.65	-2.22	0.03
CMT Lateral Rotation	47.4 $\pm$ 5.97	50.55 $\pm$ 5.61	-3.15	-1.72	0.09
Distance between the medial scapular border and T4	9.2 $\pm$ 1.17	9.35 $\pm$ 0.82	-0.13	-0.39	0.70
Distance between the acromion and bed	10.92 $\pm$ 1.29	11.0 $\pm$ 1.03	-0.07	-0.20	0.84
Numeric Rating Scale	8.47 $\pm$ 0.95	8.17 $\pm$ 1.05	0.30	0.94	0.35
Quick DASH Questionnaire	77.51 $\pm$ 7.85	74.32 $\pm$ 11.09	3.19	1.05	0.30
WORC	25.82 $\pm$ 5.36	26.08 $\pm$ 4.91	-0.26	-0.16	0.87

### 4.3.2.2 Shoulder Flexion

Flexion was improved in the kinetic control program group from 162 at baseline to 170 at follow-up, while the muscle-imbalance group improved from 163 at the baseline to 170 at follow-up. (Figure 4-11)

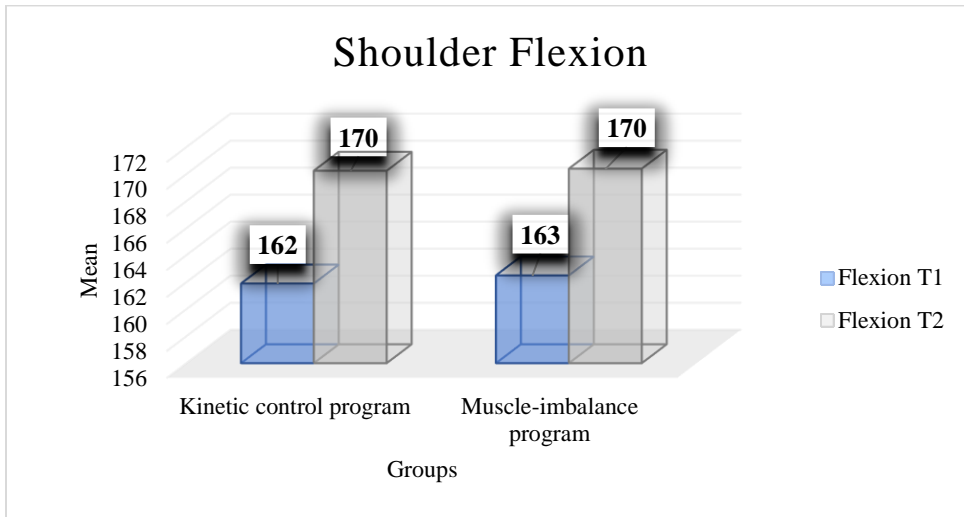


Figure 4-10 Shoulder Flexion variation

#### *Testing shoulder flexion within groups at baseline and follow-up*

**Table 4-6** Represents the mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) for the Flexion testing variables in the Muscle Imbalance Program and Kinetic Control Program at the baseline and the follow-up test. This indicates that although there is a significant difference between the two groups at the post-test, there is no significant difference between them at the baseline.

Table 4-6 Statistical results of paired sample t-test for Testing Shoulder flexion within groups at baseline and follow-up

Flexion	T1 Mean $\pm$ SD	T2 Mean $\pm$ SD	Mean Difference	t-test	Sig.
Kinetic control	161.95 $\pm$ 7.21	170.25 $\pm$ 4.94	8.3	-13.20	0.00
Muscle-imbalance	162.5 $\pm$ 6.74	170.35 $\pm$ 4.90	7.85	-12.47	0.00

*Difference of mean in flexion at follow-up between groups*

**Table 4-7** illustrates mean, standard deviation, independent sample t-test value, and the significance level (Sig.) , the comparative analysis of mean shoulder flexion at **follow up** test between two distinct treatment groups: the Kinetic control program and the Muscle-imbalance program, which indicates that although there is a noticeable variation in the mean shoulder flexion at follow-up between the two treatment groups there is no significant difference in flexion at follow-up between the two groups.

Table 4-7 Statistical results of independent sample t-test for Testing Shoulder flexion at follow-up between groups

Test	Kinetic control Mean ± SD	Muscle-imbalance Mean ± SD	Mean Difference	T- test	Sig.(2 tailed)
Flexion at follow-up	170.25± 4.94	170.35 ± 4.90	-0.1	-0.06	0.95

**4.3.2.3 Cognitive Movement-test for Shoulder Flexion**

Flexion was improved in the kinetic control program group from 151 at baseline to 161 at follow-up, while the muscle-imbalance group improved from 154 at the baseline to 161 at follow-up. (Figure 4-12)

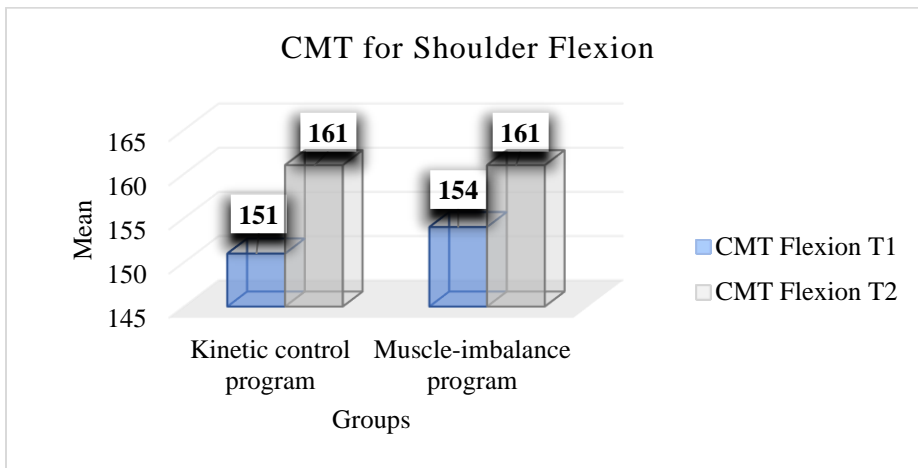


Figure 4-11 Cognitive Movement-test variation

### Testing CMT shoulder flexion within groups at baseline and follow-up

**Table 4-8** shows the mean, standard deviation, paired-samples t-test value, and significance level (Sig.) of the CMT Flexion testing variables for both the baseline and follow-up tests for the Muscle Imbalance Program and Kinetic Control Program. Both the Kinetic Control and Muscle-imbalance groups show a statistically significant increase in CMT Flexion from T1 to T2, p-values (Sig.=0.00), indicating a statistically significant difference between T1 and T2 for both groups, with the Kinetic Control group having a slightly larger mean difference.

Table 4-8 Statistical results of paired sample t-test for Testing CMT of shoulder flexion within groups at baseline and follow-up

CMT Flexion	T1 Mean ± SD	T2 Mean ± SD	Mean Difference	t-test	Sig.
Kinetic control	151.35 ± 5.04	160.95 ± 6.31	9.6	-12.06	0.00
Muscle-imbalance	153.85 ± 6.01	161.1 ± 7.45	7.25	-10.54	0.00

### Difference of mean in CMT flexion at follow-up between groups

**Table 4-9** illustrates the mean, standard deviation, independent sample t-test value, and significance level (Sig.) CMT Flexion at follow-up for both the Kinetic Control Program and the Muscle Imbalance Program, there is a very small mean difference of -0.15 in CMT Flexion at follow-up between the Kinetic Control Program and the Muscle Imbalance Program. there is a statistically non-significant difference in CMT Flexion at follow-up between the Kinetic Control and Muscle-imbalance groups p-value (Sig.=0.94).

Table 4-9 Statistical results of independent sample t-test for Testing Shoulder CMT flexion at follow-up between groups

Test	Kinetic control Mean ± SD	Muscle- imbalance Mean ± SD	Mean Difference	T-test	Sig.(2 tailed)
CMT Flexion at follow-up	160.95± 6.3	161.1 ± 7.45	-0.15	-0.06	0.94

#### 4.3.2.4 Shoulder Abduction

Abduction was improved in the kinetic control program group from **136** at baseline to **164** at follow-up, while the muscle-imbalance group improved from **149** at the baseline to **166** at follow-up. (Figure 4-13)

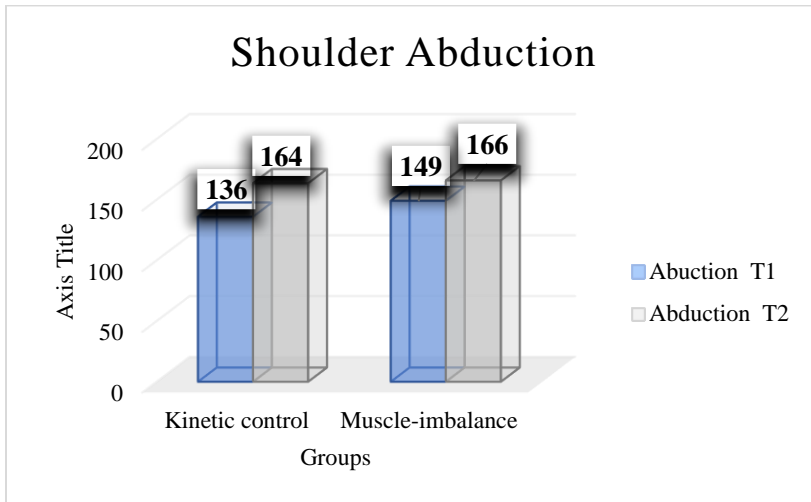


Figure 4-12 Shoulder Abduction variation

#### Testing shoulder abduction within groups at baseline and follow-up

Based on the **Table 4-10** mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) it appears that there are statistically significant changes between T1 and T2 for both Kinetic Control and Muscle Imbalance in the context of abduction., with highly significant p-values (0.00). The Kinetic control program had a slightly larger improvement in shoulder abduction (27.55) compared to the Muscle-imbalance program (16.7).

Table 4-10 Statistical results of paired sample t-test for Testing Shoulder Abduction within groups at baseline and follow-up

Abduction	T1 Mean ± SD	T2 Mean ± SD	Mean Difference	t-test	Sig.
Kinetic Control	135.95 ± 12.62	163.5 ± 7.14	27.55	12.22-	0.00
Muscle Imbalance	149.15 ± 8.98	165.85 ± 7.56	16.7	11.95-	0.00

### Difference of mean in abduction at follow-up between groups

**Table 4-11** illustrates the mean, standard deviation, independent sample t-test value, and significance level (Sig.), which show that both groups have a statistically significant difference in abduction at follow-up between Kinetic Control and Muscle Imbalance ( $p < 0.01$ ).

Table 4-11 Statistical results of independent sample t-test for Testing Shoulder Abduction at follow-up between groups

Test	Kinetic control Mean $\pm$ SD	Muscle-imbalance Mean $\pm$ SD	Mean Difference	t-test	Sig.(2 tailed)
Abduction at follow-up	163.5 $\pm$ 7.14	165.85 $\pm$ 7.56	-8.20	-2.64	0.012

#### 4.3.2.5 Cognitive Movement-test for Shoulder Abduction

Abduction was improved in the kinetic control program group from **136** at baseline to **155** at follow-up, while the muscle-imbalance group improved from **125** at the baseline to **146** at follow-up. (Figure 4-14)

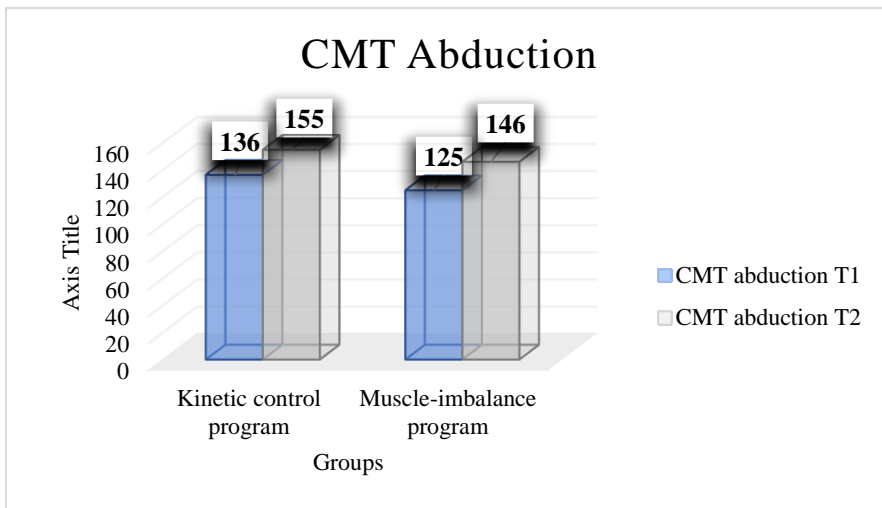


Figure 4-13 CMT Shoulder Abduction Variation

### Testing CMT shoulder abduction within groups at baseline and follow-up

According to **Table 4-12**, results illustration mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) there was a significant difference between the CMT shoulder abduction within groups at baseline and follow-up ( $P = .000$ ), CMT abduction range was a significant increase kinetic.in the more than muscle imbalance group. However, the kinetic control group had a greater mean improvement in the CMT Abduction score compared to the muscle imbalance group (mean difference = 21,  $p = 0.00$ ).

Table 4-12 Statistical results of paired sample t-test for Testing CMT of Shoulder Abduction within groups at baseline and follow-up

CMT Abduction	T1 Mean $\pm$ SD	T2 Mean $\pm$ SD	Mean Difference	t-test	Sig.
Control Kinetic	124.9 $\pm$ 14.01	145.9 $\pm$ 11.97	21	-10.04	0.00
Muscle Imbalance	136.25 $\pm$ 10.77	154.75 $\pm$ 9.96	18.5	-10.68	0.00

### Difference of mean in CMT abduction at follow-up between groups

**Table 4-13** illustrates the mean, standard deviation, independent sample t-test value, and significance level (Sig.) which show that there is a significant difference in CMT Abduction at follow-up between the Kinetic Control Program and Muscle Imbalance Program, with the Kinetic Control Program showing a higher mean.

Table 4-13 Statistical results of independent sample t-test for Testing Shoulder Abduction at follow-up between groups

Test	Kinetic control Mean $\pm$ SD	Muscle-imbalance Mean $\pm$ SD	Mean Difference	T- test	Sig. (2 tailed)
CMT Abduction at follow-up	145.9 $\pm$ 11.97	154.75 $\pm$ 9.96	8.85	2.54	0.015

### 4.3.2.6 Shoulder Extension

Extension was improved in the kinetic control program group from 25.5 at baseline to 31 at follow-up, while the muscle-imbalance group improved from 27.8 at the baseline to 29.8 at follow-up. (Figure 4-15)

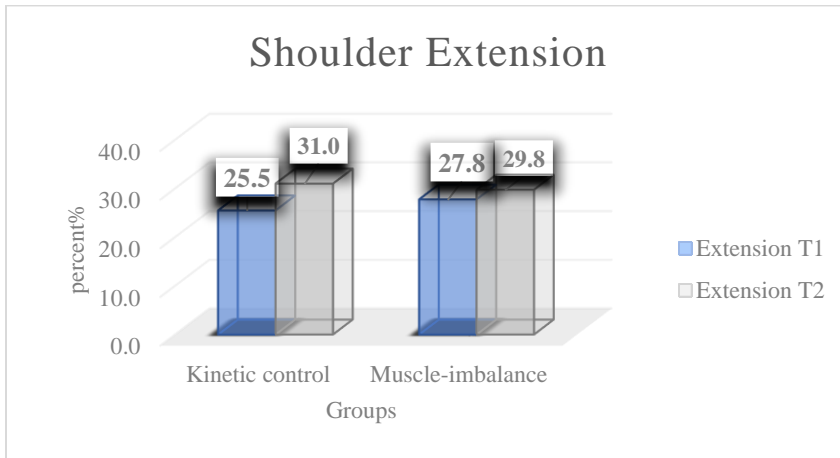


Figure 4-14 Shoulder Extension Variation

### Testing shoulder extension within groups at baseline and follow-up

According to **Table 4-14** results both groups have a statistically significant increase in extension from T1 to T2 for both the Kinetic Control and Muscle-imbalance groups. ( $P = .000$ ) as well as mean extension range was increased in the kinetic more than the muscle imbalance group.

Table 4-14 Statistical results of Wilcoxon Signed Ranks Test for Testing Shoulder Extension at baseline and follow-up

Extension	T1 Mean $\pm$ SD	T2 Mean $\pm$ SD	Mean Difference	Z-score	Sig.
Kinetic control	25.5 $\pm$ 6.66	31 $\pm$ 3.83	5.50	-3.934 <sup>b</sup>	0.00
Muscle-imbalance	27.75 $\pm$ 6.58	29.75 $\pm$ 4.43	2.00	-3.955 <sup>b</sup>	0.00

*Wilcoxon Signed Ranks Test<sup>a</sup>*

### Difference of mean in extension at follow-up between groups

According to **Table 4-15**, the mean difference, Z-score, and significance level (.632) suggest that there may not be a significant difference between the two groups in extension at follow-up, as the p-value > 0.05 for statistical significance.

Table 4-15 Statistical results of Mann-Whitney U Test for Testing Shoulder Extension at Baseline and follow-up

Test	Kinetic control Mean ± SD	Muscle-imbalance Mean ± SD	Mean Difference	Z- score	Sig.(2 tailed)
Extension at Follow-up	31 ± 3.83	29.75 ± 4.43	1.25	182.50	.632

*Mann-Whitney U*

#### 4.3.2.7 Cognitive Movement-test for Shoulder Extension

Extension was improved in the kinetic control program group from **23** at baseline to **28** at follow-up, while the muscle-imbalance group improved from **25** at the baseline to **29** at follow-up. (Figure 4-16)

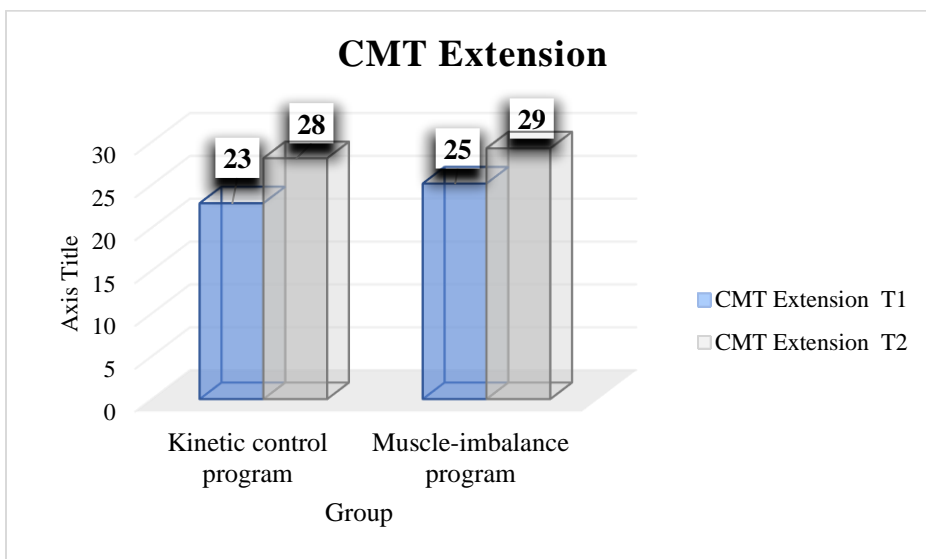


Figure 4-15 CMT Extension variation

### Testing CMT shoulder extension within groups at baseline and follow-up

According to **Table 4-16** of mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) results CMT Extension significantly increased Kinetic Control from baseline to follow-up) with a mean improvement of 5.25. also, it increased in the muscle imbalance group significantly increased from baseline to follow-up with a mean improvement of 4.1.

Table 4-16 Statistical results of paired sample t-test for Testing CMT of Shoulder Extension within groups at baseline and follow-up

CMT extension	T1 Mean ± SD	T2 Mean ± SD	Mean Difference	t-test	Sig.
Kinetic Control	22.85 ± 3.55	28.1 ± 2.7	5.25	-11.6	0.00
Muscle Imbalance	25.15 ± 14.01	29.25 ± 2.95	4.1	-11.56	0.01

### Difference of mean in extension at follow-up between groups

According to **Table 4-17** illustration of mean, standard deviation, independent sample t-test value, and the significance level (Sig.), there is no significant difference in CMT Extension at follow-up between the Kinetic Control Program and Muscle Imbalance Program (p-value = 0.207).

Table 4-17 Statistical results of independent sample t-test for Testing Shoulder CMT Extension at follow-up between groups

Test	Kinetic control Mean ± SD	Muscle-imbalance Mean ± SD	Mean Difference	t-test	Sig. (2 tailed)
CMT Extension at follow-up	28.1 ± 2.71	29.25 ± 2.95	-1.15	-1.28	0.207

### 4.3.2.8 Shoulder Medial Rotation

Medial Rotation was improved in the kinetic control program group from **51** at baseline to **77** at follow-up, while the muscle-imbalance group improved from **54** at the baseline to **73** at follow-up. (Figure 4-17)

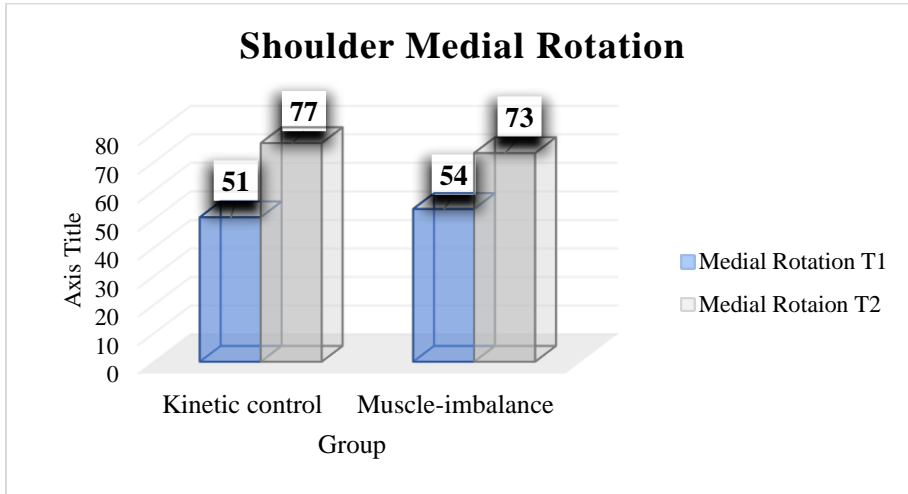


Figure 4-16 Shoulder Medial Rotation Variation

### Testing shoulder medial rotation within groups at baseline and follow-up

According to **Table 4-18** illustrations of mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) there was a statistically significant mean difference in kinetic control group in medial rotation between T1 and T2, as the p-value (Sig.) < 0.05 (0.040). as well as there was no statistically significant mean difference for the Muscle Imbalance group in medial rotation between T1 and T2, as the p-value (Sig.) > 0.05 (0.784).

Table 4-18 Statistical results of paired sample t-test for Testing of Shoulder Medial Rotation within groups at baseline and follow-up

Medial Rotation	T1 Mean ± SD	T2 Mean ± SD	Mean Difference	t-test	Sig.
Kinetic Control	50.65 ± 7.19	76.65 ± 5.94	26	-16.85	0.040
Muscle Imbalance	53.55 ± 6.64	73.15 ± 6.03	19.6	-9.46	0.784

### Difference of mean in medial rotation at follow-up between groups

Table 4-19 illustration of mean, standard deviation, independent sample t-test value, and significance level (Sig.) there is a significant difference in medial rotation at follow-up between the Kinetic Control Program and Muscle Imbalance Program, with the Kinetic Control Program showing a higher mean. p-value (Sig.) < 0.05

Table 4-19 Statistical results of independent sample t-test for Testing Shoulder Medial Rotation at follow-up between groups

Test	Kinetic control Mean ± SD	Muscle imbalance Mean ± SD	Mean Difference	t-test	Sig. (2 tailed)
Medial Rotation at follow-up	76.65 ± 5.94	73.15 ± 6.03	-2.90	-1.32	0.015

#### 4.3.2.9 Cognitive Movement-test for Shoulder Medial Rotation

CMT Medial Rotation was improved in the kinetic control program group from **43** at baseline to **64** at follow-up, while the muscle-imbalance group improved from **47** at the baseline to **64** at follow-up. (Figure 4-18)

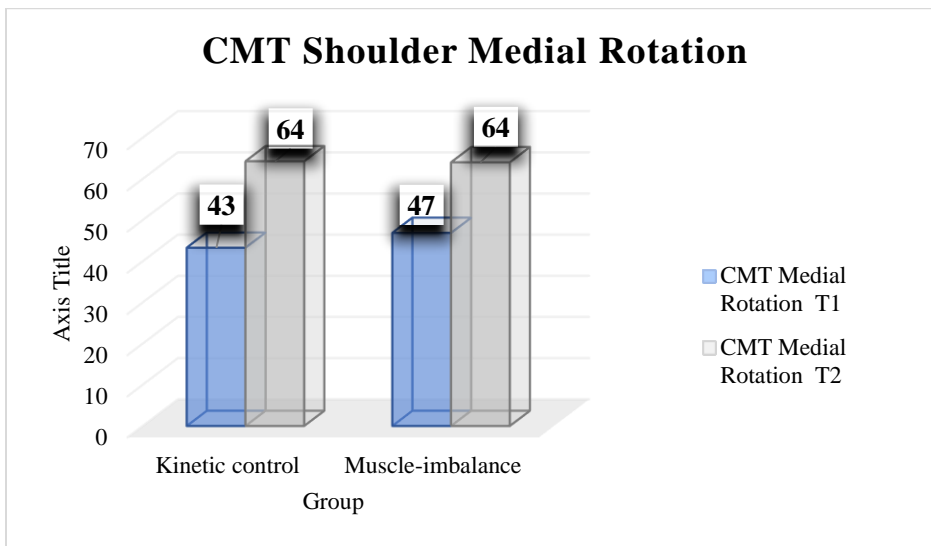


Figure 4-17 CMT Shoulder Medial Rotation variation

### Testing CMT Shoulder Medial Rotation within groups at baseline and follow-up

According to **table 4-20** illustration of mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) there was a statistically significant mean difference in kinetic control group in CMT medial rotation between T1 and T2, there is a statistically significant mean difference in CMT Medial Rotation, as the p-value (Sig.) < 0.05 (0.005) also in Muscle Imbalance group, there is also a statistically significant mean difference in CMT Medial Rotation between T1 and T2, as the p-value (Sig.) < 0.05 (0.034).

Table 4-20 Statistical results of paired sample t-test for Testing of CMT Shoulder Medial Rotation within groups at baseline and follow-up

CMT Medial Rotation	T1 Mean ± SD	T2 Mean ± SD	Mean Difference	t-test	Sig.
Kinetic Control	43.3 ± 7.19	64.3 ± 5.94	21	-13.94	0.005
Muscle Imbalance	46.9 ± 5.70	64.05 ± 66.48	17.15	-9.46	0.034

### Difference of mean in CMT medial rotation at follow-up between groups

According to **Table 4-21** illustration mean, standard deviation, independent sample t-test value, and the significance level (Sig.), the mean difference between the Kinetic Control Program and Muscle Imbalance Program at follow-up for CMT Medial Rotation is very small, with a mean difference of (0.25).

Table 4-21 Difference of mean in CMT medial rotation at follow-up between groups

Test	Kinetic control Mean ± SD	Muscle imbalance Mean ± SD	Mean Difference	t-test	Sig. (2 tailed)
CMT Medial Rotation at follow-up	64.3 ± 8.77	64.05 ± 6.48	0.25	0.102	0.919

#### 4.3.2.10 Shoulder Lateral Rotation

Lateral Rotation was improved in the kinetic control program group from 43.3 at baseline to 62.3 at follow-up, while the muscle-imbalance group improved from 45.3 at the baseline to 65.5 at follow-up. (Figure 4-19)

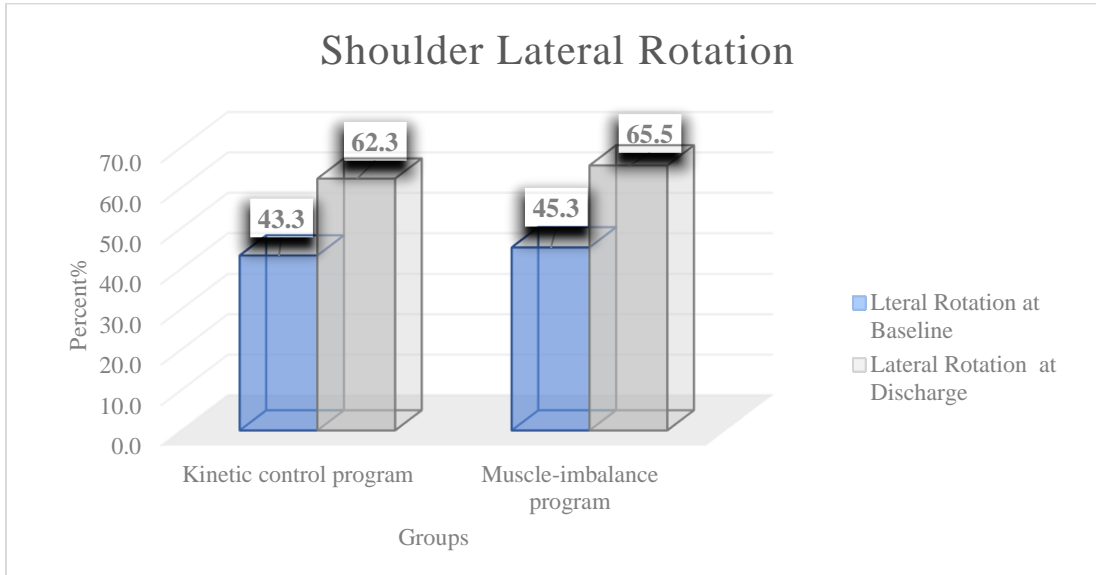


Figure 4-18 Shoulder Lateral Rotation Variation

#### Testing shoulder lateral rotation within groups at baseline and follow-up

According to **Table 4-22** illustration of mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) in both the Kinetic Control and Muscle Imbalance groups, there is a statistically significant mean difference in lateral rotation between T1 and T2, as the p-value (Sig.) is less than 0.05 (0.00). In the Kinetic Control group, participants had a mean lateral rotation of 53.85 at T1, which increased to 68.2 at T2 while in the Muscle Imbalance group, participants had a mean lateral rotation of 58.5 at T1, which increased to 68.6 at T2.

Table 4-22 Statistical results of paired sample t-test for Testing of Shoulder Lateral Rotation within groups at baseline and follow-up

Group	Lateral Rotation T1 Mean $\pm$ SD	Lateral Rotation T2 Mean $\pm$ SD	Mean Difference	t-test	Sig.
Kinetic Control	53.85 $\pm$ 7.42	68.2 $\pm$ 4.52	14.35	-13.21	0.00
Muscle Imbalance	58.5 $\pm$ 5.71	68.6 $\pm$ 3.97	10.1	-12.77	0.00

### Difference of mean in lateral rotation at follow-up between groups

According to **Table 4-23** illustration of mean, standard deviation, independent sample t-test value, and the significance level (Sig.), there is no significant difference in Lateral Rotation at follow-up between the Kinetic Control Program and Muscle Imbalance Program.

Table 4-23 Statistical results of independent sample t-test for Testing Shoulder Lateral Rotation at follow-up between groups

Test	Kinetic control Mean $\pm$ SD	Muscle imbalance Mean $\pm$ SD	Mean Difference	t-test	Sig. (2 tailed)
Lateral Rotation at follow-up	68.2 $\pm$ 4.52	68.6 $\pm$ 3.97	-0.39	-0.29	0.76

#### 4.3.2.11 Cognitive Movement-test for Shoulder Lateral Rotation

CMT Lateral Rotation was improved in the kinetic control program group from **47** at baseline to **57** at follow-up, while the muscle-imbalance group improved from **51** at the baseline to **60** at follow-up. (Figure 4-20)

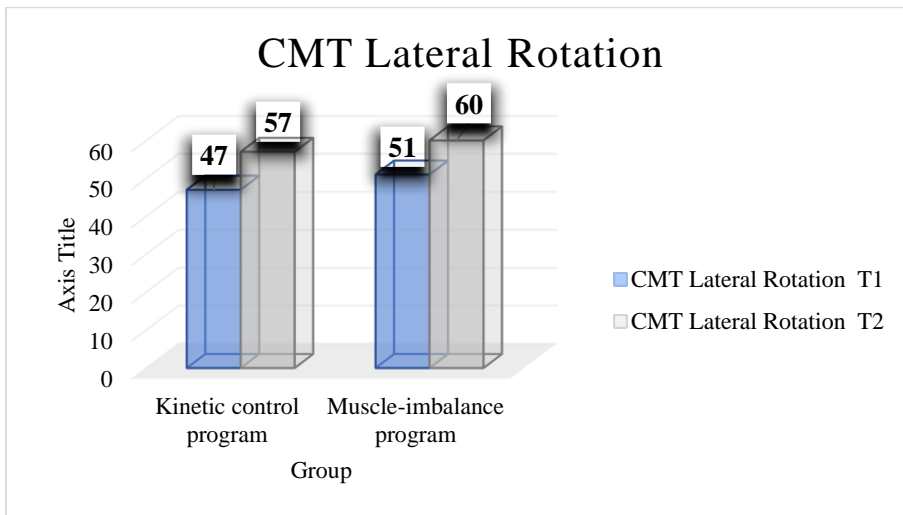


Figure 4-19 CMT Lateral Rotation variation

### Testing CMT shoulder lateral rotation within groups between baseline and follow-up

According to **Table 4-24** illustration of mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) in both the Kinetic Control and Muscle Imbalance groups there was a statistically significant increase in CMT Lateral Rotation from T1 to T2, as the p-value (Sig.) is less than 0.05 (0.00). In the Kinetic Control group, participants had a mean lateral rotation of 47.4 at T1, which increased to 57.35 at T2 while in the Muscle Imbalance group, participants had a mean lateral rotation of 50.55 at T1, which increased to 59.85 at T2.

Table 4-24 Statistical results of paired sample t-test for Testing of CMT Shoulder Lateral Rotation within groups at baseline and follow-up

Group	CMT Lateral Rotation T1 Mean ± SD	CMT Lateral Rotation T2 Mean ± SD	Mean Difference	t-test	Sig.
Kinetic Control	47.4 ± 5.97	57.35 ± 6.55	9.95	-12.44	0.00
Muscle Imbalance	50.55 ± 5.61	59.85 ± 6.18	9.3	-13.43	0.00

### Difference of mean in CMT lateral rotation at follow-up between groups

According to **Table 4-25** illustrates of mean, standard deviation, independent sample t-test value, and significance level (Sig.), there is no significant difference in CMT Lateral Rotation at follow-up between the Kinetic Control Program and Muscle Imbalance Program.

Table 4-25 Statistical results of independent sample t-test for Testing Shoulder CMT Lateral Rotation at follow-up between groups

Test	Kinetic control Mean ± SD	Muscle imbalance Mean ± SD	Mean Difference	t-test	Sig. (2 tailed)
CMT Lateral Rotation at follow-up	57.35 ± 6.55	59.85 ± 6.18	-2.5	-1.24	0.22

### 4.3.3 Scapular Clinical Static Test

#### 4.3.3.1 Distance between the medial scapular border and T4

Distance Between medial scapular border and T4 was decreased in the kinetic control program group from **9.20** at baseline to **7.82** at follow-up, while the muscle-imbalance group decreased from **9.35** at the baseline to **8.13** at follow-up. (Figure 4-21)

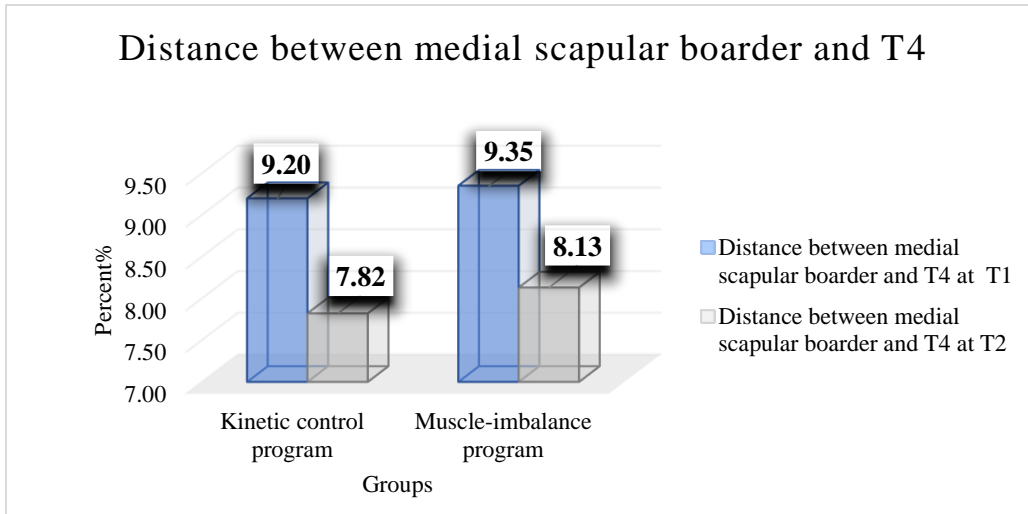


Figure 4-20 Distance between medial scapular border and T4 variations

#### Testing Distance between the medial scapular border and T4 within groups at baseline and follow-up

**Table 4-26** illustrates of mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) results that both the Kinetic Control and Muscle Imbalance groups experienced a statistically significant decrease in the distance between the medial scapular border and T4 from T1 to T2 ( $P = .000$ ), For the Kinetic Control group, the mean distance decreased by -1.45 cm, while Muscle Imbalance group, the mean distance decreased by -1.27 cm.

Table 4-26 Statistical results of paired sample t-test for Testing Distance between the medial scapular border and T4 within groups at baseline and follow-up

<b>Distance between the medial scapular border and T4</b>	<b>T1 Mean ± SD</b>	<b>T2 Mean ± SD</b>	<b>Mean difference</b>	<b>t-test</b>	<b>Sig.</b>
Kinetic control	9.2 ± 1.17	7.82 ± 1.42	-1.45	11.13	0.00
Muscle-imbalance	9.35 ± 0.82	8.13 ± 1.25	-1.27	8.44	0.00

**Difference of mean Distance between the medial scapular border and T4 at follow-up between groups**

According to **Table 4-27** based on the statistical analysis, there is no significant difference in the distance between the medial scapular border and T4 at follow-up between the Kinetic Control Program and Muscle Imbalance Program p-value (**Sig.**) = **0.47**.

Table 4-27 Statistical results of independent sample t-test for Testing Distance between the medial scapular border and T4 at follow-up for both group

<b>Test</b>	<b>Kinetic control Mean ± SD</b>	<b>Muscle imbalance Mean ± SD</b>	<b>Mean Difference</b>	<b>t-test</b>	<b>Sig. (2 tailed)</b>
Distance between the medial scapular border and T4	7.82 ± 1.42	8.13 ± 1.25	-0.304	-0.71	0.47

### 4.3.3.2 Distance between Acromion and Bed

Distance between Acromion and Bed was decreased in the kinetic control program group from 10.95 at baseline to 9.2 at follow-up, while the muscle-imbalance group decreased from 11 at the baseline to 9.4 at follow-up. (Figure 4-22)

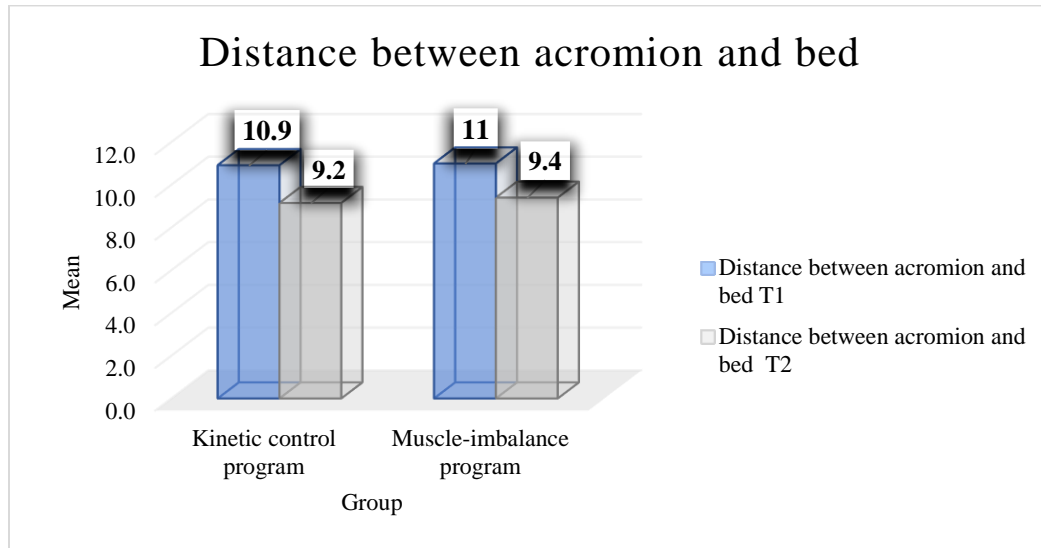


Figure 4-21 Distance between Acromion and Bed variations

### Testing Distance between acromion and bed within groups at baseline and follow-up

**Table 4-28** illustrates of mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) result that both the Kinetic Control and Muscle Imbalance groups experienced a statistically significant decrease in the distance between the Acromion and Bed from T1 to T2 ( $P = .000$ ), For the Kinetic Control group, the mean distance decreased by -1.3 cm also, Muscle Imbalance group, the mean distance decreased by -1.05 cm.

Table 4-28 Statistical results of paired sample t-test for Testing Distance between Acromion and Bed

Distance between Acromion and Bed	T1 Mean $\pm$ SD	T2 Mean $\pm$ SD	difference	t-test	Sig.
Kinetic control	10.92 $\pm$ 1.29	9.55 $\pm$ 1.40	-1.3	12.37	0.00
Muscle-imbalance	11.0 $\pm$ 1.03	9.67 $\pm$ 1.01	-1.05	5.48	0.00

### Difference of mean Distance between the acromion and bed at follow-up between groups

According to Table 4-29 statistical analysis, there is no significant difference in the distance between the Acromion and Bed at follow-up between the Kinetic Control Program and Muscle Imbalance Program. the p-value (Sig.) is **0.509**.

Table 4-29 Statistical results of independent sample t-test for Testing Distance between the acromion and bed at follow-up for both groups

Test	Kinetic control Mean $\pm$ SD	Muscle imbalance Mean $\pm$ SD	Mean Difference	t-test	Sig. (2 tailed)
Distance between acromion and bed	9.15 $\pm$ 1.33	9.4 $\pm$ 1.01	-0.25	-0.66	0.509

#### 4.3.4 Numeric Rating Scale

Numeric Rating Scale was decreased in the kinetic control program group from 8.5 at baseline to 3.58 at follow-up, while the muscle-imbalance group decreased from 8.2 at the baseline to 3.7 at follow-up. (Figure 4-23)

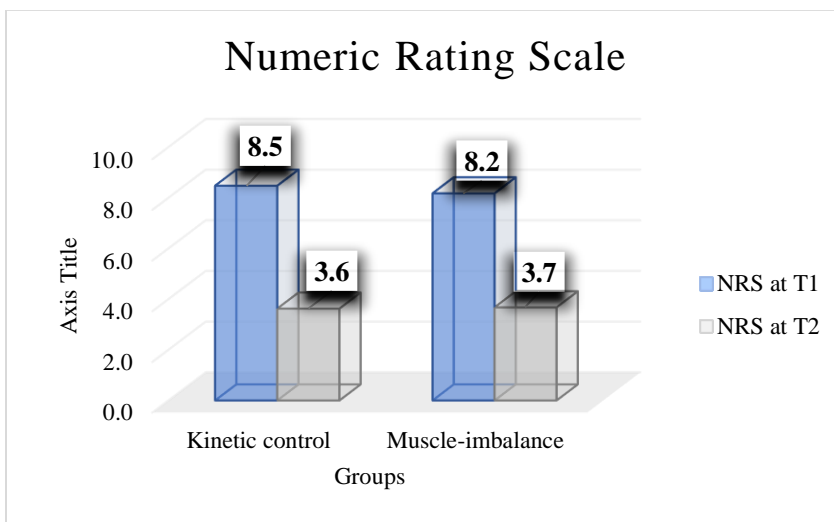


Figure 4-22 Numeric Rating Scale

### Testing the Numeric Rating Scale within groups at baseline and follow-up

Table 4-30 illustrates that both the Kinetic Control and Muscle Imbalance groups experienced a statistically significant decrease in the Numeric Rating Scale score from T1 to T2. For the Kinetic Control group, the mean Numeric Rating Scale score was 8.47 at T1, which decreased to 3.62 at T2. While in the Muscle Imbalance group, the mean score was 8.17 at T1, which decreased to 3.67 at T2.

Table 4-30 Testing Numeric Rating Scale at baseline and follow-up

<b>Numeric Rating Scale</b>	<b>T1 Mean ± SD</b>	<b>T2 Mean ± SD</b>	<b>difference</b>	<b>Z</b>	<b>Sig.</b>
Kinetic control	8.47 ± 0.95	3.62 ± 0.98	-4.85	-3.936 <sup>c</sup>	0.00
Muscle-imbalance	8.17 ± 1.05	3.67 ± 1.01	-4.5	-3.930 <sup>c</sup>	0.00

a. Wilcoxon Signed Ranks Test

### Difference of mean numeric rating scale at follow-up between groups

According to Table 4-31 statistical analysis, there is no significant difference in the Numeric Rating Scale scores at follow-up between the Kinetic Control Program and Muscle Imbalance Program p-value (Sig.) = **0.875**.

Table 4-31 Statistical results of Mann-Whitney U Test for Testing Numeric Rating Scale at baseline and follow-up

<b>Test</b>	<b>Kinetic control Mean ± SD</b>	<b>Muscle-imbalance Mean ± SD</b>	<b>Mean Difference</b>	<b>Z</b>	<b>Sig.(2 tailed)</b>
Numeric Rating Scale	3.62 ± 0.98	3.67 ± 1.01	-0.05	195.0	0.875

Mann-Whitney U

### 4.3.5 Quick DASH Questionnaire

Quick DASH Questionnaire was decreased in the kinetic control program group from 77.52 at baseline to 33.36 at follow-up, while the muscle-imbalance group decreased from 74.33 at the baseline to 29.88 at follow-up. (Figure 4-24)

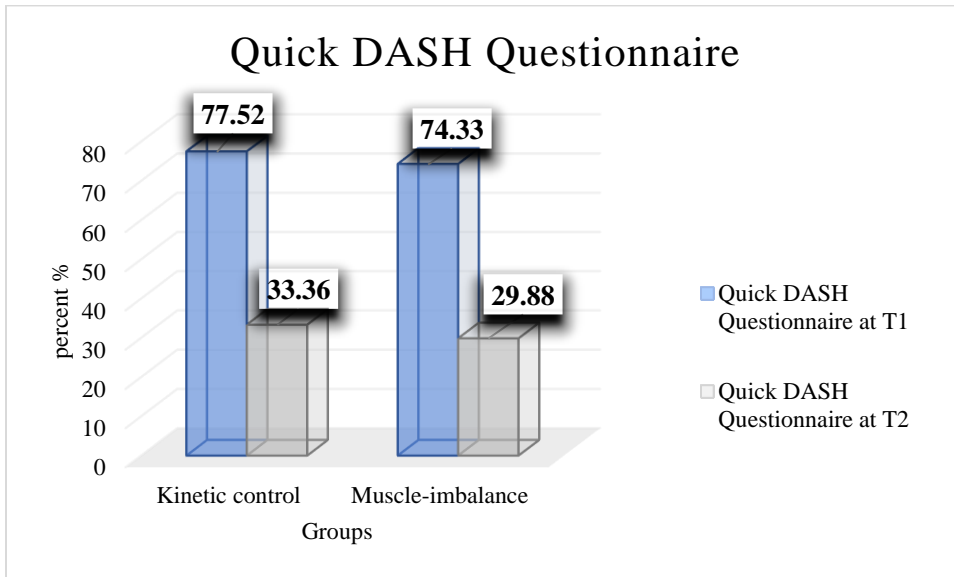


Figure 4-23 Quick DASH Questionnaire variations

### Testing Quick DASH Questionnaire within groups at baseline and follow-up

According to **Table 4-32** results, there was a significant difference in the Quick DASH Questionnaire in the kinetic control group at baseline and follow-up ( $P = .000$ ), as well as there's also a significant difference between the muscle imbalance group at baseline and follow-up ( $P = .000$ ).

Table 4-32 Statistical results of Wilcoxon Signed Ranks Test for Testing Quick DASH at baseline and follow-up

Quick DASH Questionnaire	T1 Mean $\pm$ SD	T2 Mean $\pm$ SD	difference	Z	Sig.
Kinetic control	77.51 $\pm$ 7.85	33.35 $\pm$ 7.81	-44.2	-3.923 <sup>b</sup>	0.00
Muscle-imbalance	74.32 $\pm$ 11.09	29.87 $\pm$ 10.63	-44.45	-3.925 <sup>b</sup>	0.00

Wilcoxon Signed Ranks Test

### Difference of mean of Quick DASH Questionnaire at follow-up between groups

According to **Table 4-33** based on the statistical analysis, there is no significant difference in the Quick DASH Questionnaire scores at follow-up between the Kinetic Control Program and Muscle Imbalance Program. p-value (Sig.) is 0.25

Table 4-33 Statistical results of Mann-Whitney U Test for Testing Quick DASH Questionnaire at baseline and follow-up

Test	Kinetic control Mean $\pm$ SD	Muscle-imbalance Mean $\pm$ SD	Mean Difference	Z	Sig. (2 tailed)
Quick DASH Questionnaire	33.35 $\pm$ 7.81	29.87 $\pm$ 10.63	3.48	163.500	0.25

Mann-Whitney U

### 4.3.6 Western Ontario Rotator Cuff Index (WORC)

Western Ontario Rotator Cuff Index was increased in the kinetic control program group from 26 at baseline to 72 at follow-up, while the muscle-imbalance group increased from 26 at the baseline to 71 at follow-up. (Figure 4-25)

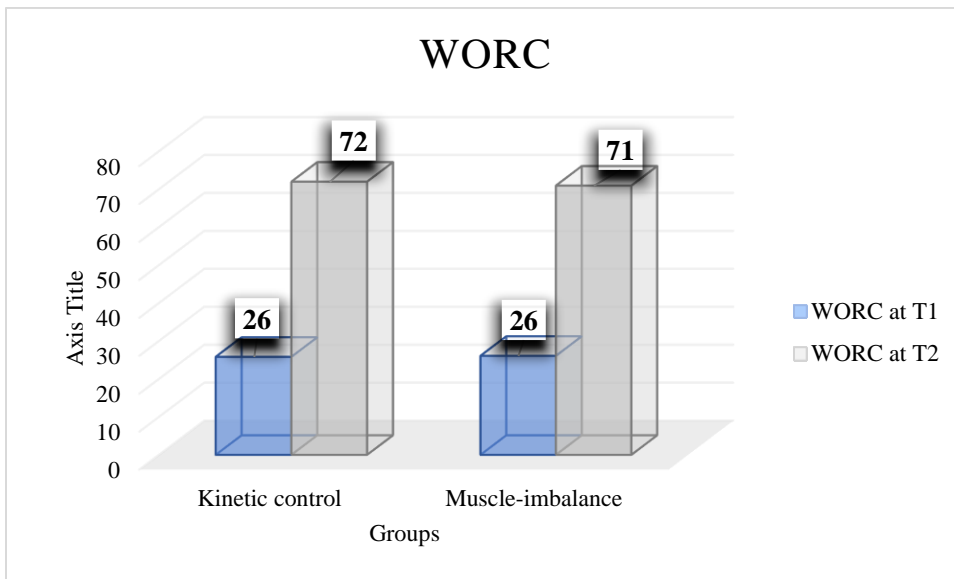


Figure 4-24 Western Ontario Rotator Cuff Index variation

### Testing WORC within groups at baseline and follow-up

According to **Table 4-34** results, there was a significant difference in Western Ontario Rotator Cuff Index in the kinetic control group at baseline and follow-up ( $P = .000$ ), as well as there's also significant difference between the muscle imbalance group at baseline and follow up ( $P = .000$ ).

Table 4-34 Statistical results of Wilcoxon Signed Ranks Test for Testing WORC at baseline and follow-up

<b>WORC</b>	<b>T1</b> Mean $\pm$ SD	<b>T2</b> Mean $\pm$ SD	difference	Z-Score	Sig.
Kinetic control	25.82 $\pm$ 5.36	71.98 $\pm$ 5.63	46.15	-3.920 <sup>b</sup>	0.00
Muscle-imbalance	26.08 $\pm$ 4.91	70.93 $\pm$ 7.04	44.85	-3.921 <sup>b</sup>	0.00

a. Wilcoxon Signed Ranks Test

### Difference of mean WORC at follow-up between groups

According to **Table 4-35** based on the statistical analysis, there is no significant difference in the WORC scores at follow-up between the Kinetic Control Program and Muscle Imbalance Program. p-value (Sig.) is 0.60

Table 4-35 Statistical results of Mann-Whitney U Test for Testing WORC at baseline and follow-up

<b>Test</b>	<b>Kinetic control</b> Mean $\pm$ SD	<b>Muscle-imbalance</b> Mean $\pm$ SD	Mean Difference	Z	Sig. (2 tailed)
<b>WORC</b>	71.98 $\pm$ 5.63	70.93 $\pm$ 7.04	1.04	181.500	0.607

Mann-Whitney U

### 4.3.7 Orthopedic Tests of both groups (at baseline and follow-up)

Both the Kinetic Control and Muscle Imbalance programs appear effective in improving the outcomes of the assessed clinical tests (Figure 4-26)

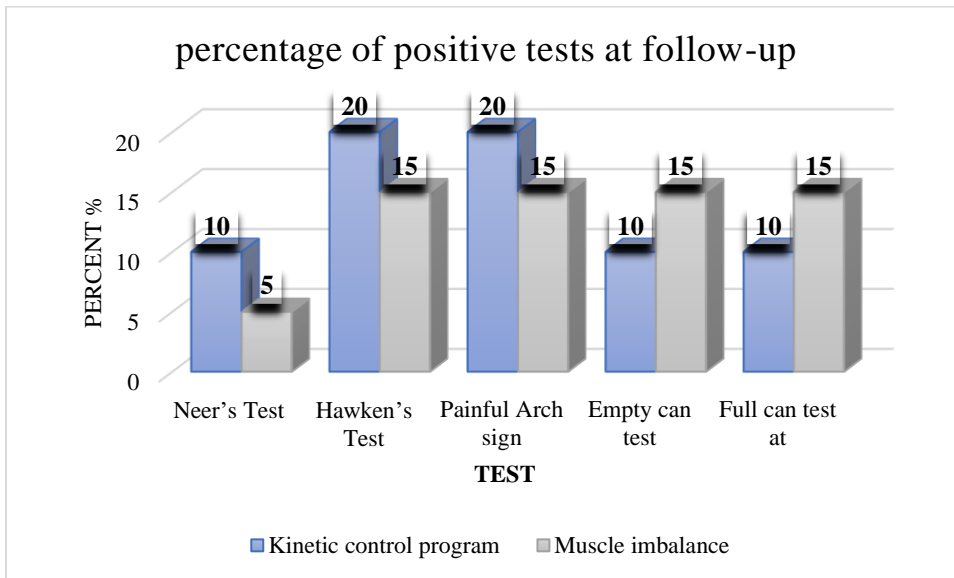


Figure 4-25 percentage of positive tests at follow-up

According to table 4-36 both the Kinetic Control and Muscle Imbalance programs show significant improvements in all tests (Neer's Test, Hawken's Test, Painful Arch Sign, Empty Can Test, Full Can Test). The improvements are highly significant ( $p < 0.05$ ) for most tests in both programs, indicating positive outcomes in the post-intervention percentages compared to the pre-intervention percentages.

Table 4-36 percentage of positive tests in baseline and follow-up in both groups

Test	Kinetic control program					Muscle imbalance			
	pre%	post%	chi	sig		pre%	post%	chi	sig
Neer's Test	95	10	12.800 <sup>a</sup>	.000		90	5	16.200 <sup>a</sup>	.000
Hawken's Test	85	20	7.200 <sup>a</sup>	.000		90	15	9.800 <sup>a</sup>	.000
Painful Arch sign	85	20	7.200 <sup>a</sup>	.007		80	15	9.800 <sup>a</sup>	.002
Empty can test	75	10	12.800 <sup>a</sup>	.000		70	15	9.800 <sup>a</sup>	.002
Full can test at	60	10	9.800 <sup>a</sup>	.002		45	15	16.200 <sup>a</sup>	.000

#### 4.4 Differences in mean between two groups in terms of all research variable improvement

**Table 4-37** illustrates of mean, standard deviation, paired-samples t-test value, and the significance level (Sig.) result of the differences in means between two groups (the "Kinetic control program" and the "Muscle-imbalance program") for various research variables that measure improvements which summarize that there is no significant difference in (Flexion, CMT Abduction, Extension , CMT Extension, Medial Rotation, CMT Medial Rotation, CMT Lateral Rotation, Distance between the medial scapular border and T4, Distance between the acromion and bed, Numeric Rating Scale, Quick DASH, WORC) ( $p > 0.05$ ) while there is significant difference in improvement of **CMT Flexion, Abduction, Lateral Rotation** ( $p < 0.05$ ).

Table 4-37 Statistical results paired-samples t-test for Testing Improvement in all research variable

Test	Kinetic control Mean $\pm$ SD	Muscle-imbalance Mean $\pm$ SD	Mean Difference	T-test	Sig. (2 tailed)
Flexion	8.3 $\pm$ 2.81	7.85 $\pm$ 2.81	0.45	0.51	0.62
CMT Flexion	9.6 $\pm$ 3.56	7.25 $\pm$ 3.07	2.35	2.23	0.03
Abduction	27.5 $\pm$ 10.06	16.6 $\pm$ 6.42	-10.90	-4.08	0.00
CMT Abduction	21.45 $\pm$ 8.40	19 $\pm$ 6.95	-2.45	-1.00	0.32
Extension	4.55 $\pm$ 1.35	3.60 $\pm$ 2.13	0.95	1.68	0.10
CMT Extension	5.05 $\pm$ 1.6	4.25 $\pm$ 1.51	0.8	1.62	0.11
Medial Rotation	22.75 $\pm$ 6.95	21.2 $\pm$ 6.83	1.55	0.711	0.48
CMT Medial Rotation	20.4 $\pm$ 7.97	17.75 $\pm$ 4.42	2.65	1.30	0.20
Lateral Rotation	14.35 $\pm$ 4.85	10.10 $\pm$ 3.53	4.25	3.16	0.00
CMT Lateral Rotation	10.2 $\pm$ 3.30	9.4 $\pm$ 2.87	0.8	0.82	0.42
Distance between the medial scapular border and T4	-1.22 $\pm$ 0.71	-0.97 $\pm$ 0.61	-0.25	-1.18	0.24
Distance between the acromion and bed	-1.3 $\pm$ 0.470	-1.05 $\pm$ 0.856	0.8	0.82	0.42
Numeric Rating Scale	-4.8 $\pm$ 1.05	-4.45 $\pm$ 1.45	-0.35	-0.87	0.38
Quick DASH Questionnaire	-44.16 $\pm$ 8.67	-44.45 $\pm$ 13.28	0.29	0.08	0.94
WORC	46.15 $\pm$ 7.11	44.85 $\pm$ 6.80	1.306	0.59	0.56

#### 4.5 Multi-variate analysis (regression) for predictors of improvement

Referring to Table 4-37 there is a significant difference in the improvement of **CMT Flexion, Abduction, and Lateral Rotation**, so the multivariate analysis was done to summarize the predictors of improvement of this improvement

##### 4.5.1 CMT Flexion Improvement Multivariate Analysis

As shown below in **Table 4-38** the regression model indicates that .498 of the CMT Flexion improvement variation is explained by the below regression model ( $R^2 = 0.248$ ). ( $P = 0.021$ ), the variation in the CMT Flexion improvement is predicted significantly by 2 independent variables, Patient group ( $B = -2.365$ ), and BMI ( $B = -2.279$ ).

Table 4-38 Multivariate Regression of CMT Flexion Improvement

Model	R	R Square	Adjusted R Square	SD. Error of the Estimate
2	.498 <sup>b</sup>	.248	.208	3.10901

- a. Predictors: (Constant), BMI
- b. Predictors: (Constant), BMI, Patient Group
- c. Dependent Variable: imp.CMT.flexion

##### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	118.136	2	59.068	6.111	.005 <sup>c</sup>
	Residual	357.639	37	9.666		
	Total	475.775	39			

- a. Dependent Variable: imp.CMT.flexion
- b. Predictors: (Constant), BMI
- c. Predictors: (Constant), BMI, Patient Group

##### Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	SD. Error	Beta		
2	(Constant)	19.809	3.450		5.741	.000
	BMI	-.279	.109	-.364	-2.551	.015
	Patient Group	-2.365	.983	-.343	-2.406	.021

- a. Dependent Variable: imp.CMT.flexion

#### 4.5.2 Abduction Improvement Multivariate Analysis

As shown below in **Table 4-39** the regression model indicates that .552 of the abduction variations is explained by the below regression model ( $R^2 = 0.305$ ). ( $P = 0.000$ ), the variation in the abduction improvement is predicted significantly by independent variables, Patient group ( $B=10.90$ ).

Table 4-39 Multivariate Regression of Abduction improvement

Model	R	R Square	Adjusted R Square	SD. Error of the Estimate
1	.552 <sup>a</sup>	.305	.287	8.44144

a. Predictors: (Constant), Patient Group

b. Dependent Variable: imp.abd

#### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1188.100	1	1188.100	16.673	.000 <sup>b</sup>
	Residual	2707.800	38	71.258		
	Total	3895.900	39			

a. Dependent Variable: imp.abd

b. Predictors: (Constant), Patient Group

#### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	SD. Error	Beta		
1	(Constant)	5.700	4.221		1.350	.185
	Patient Group	10.900	2.669	.552	4.083	.000

a. Dependent Variable: imp.abd

### 4.5.3 Lateral Rotation Improvement Multivariate Analysis

As shown below in **Table 4-40** the regression model indicates that .573 of the lateral rotation improvement variations are explained by the below regression model ( $R^2 = 0.329$ ). ( $P = 0.001$ ), the variation in the lateral rotation improvement is predicted significantly by 2 independent variables, Patient group ( $B = -4.231$ ), and BMI ( $B = 0.360$ ).

Table 4-40 Multivariate Regression of Lateral Rotation Improvement

Model	R	R Square	Adjusted R Square	SD. Error of the Estimate
2	.573 <sup>b</sup>	.329	.292	3.96593

- a. Predictors: (Constant), Patient Group
- b. Predictors: (Constant), Patient Group, BMI
- c. Dependent Variable: imp.LateralR

#### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
	Total	866.975	39			
2	Regression	285.016	2	142.508	9.060	.001 <sup>c</sup>
	Residual	581.959	37	15.729		
	Total	866.975	39			

- a. Dependent Variable: imp.LateralR
- b. Predictors: (Constant), Patient Group
- c. Predictors: (Constant), Patient Group, BMI

#### Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	SD. Error	Beta		
2	(Constant)	8.477	4.401		1.926	.062
	Patient Group	-4.231	1.254	-.454	-3.373	.002
	BMI	.360	.140	.347	2.576	.014

- a. Dependent Variable: imp.LateralR

#### 4.5.4 Difference of mean improvement of the main outcome measures of the two groups combined according to the diagnosis

Further into analyzing the difference of improvement, as shown in **Table 4-41** and **Figures 4.27 -4.29** there was no statistically significant difference in improvement of the main outcome measures (pain, distance of the scapula from the spins, and Dash) according to the diagnosis

Table 4-41 Variation of improvement based on diagnosis

Diagnosis	Improvement	Kinetic control		Muscle-imbalance		F	Sig.
		Mean	SD. Deviation	Mean	SD. Deviation		
Rotator Cuff Tendinopathy	imp. distance	-.33	0.29	-1.25	1.19	3.996	.038
	imp.NRS	-3.50	0.50	-3.38	1.84		
	imp.QDASH	-52.23	7.51	-57.40	11.93		
Rotator Cuff Tendinitis	imp.distance1	-1.31	0.63	-0.78	0.44	4.996	0.131
	imp.NRS	-5.12	0.89	-4.72	1.60		
	imp.QDASH	-40.81	7.25	-41.30	13.28		
Impingement syndrome	imp. distance	-1.63	0.75	-1.07	0.35	5.996	0.203
	imp.NRS	-4.75	1.26	-4.71	0.76		
	imp.QDASH	-49.00	9.15	-41.10	10.63		

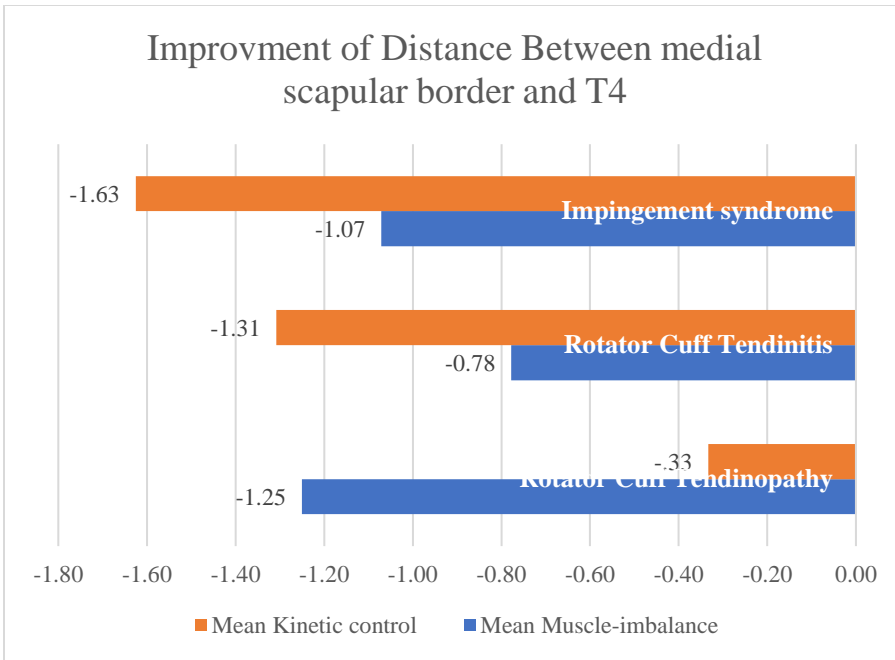


Figure 4-26 Distance between Medial Scapular Border and T4 improvement according to diagnosis

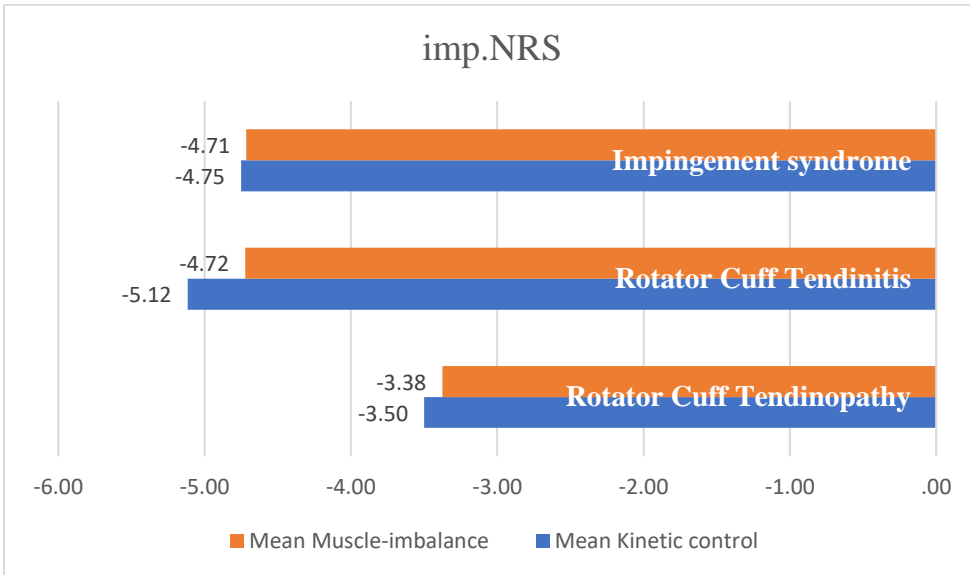


Figure 4-27 NRS improvement according to diagnosis

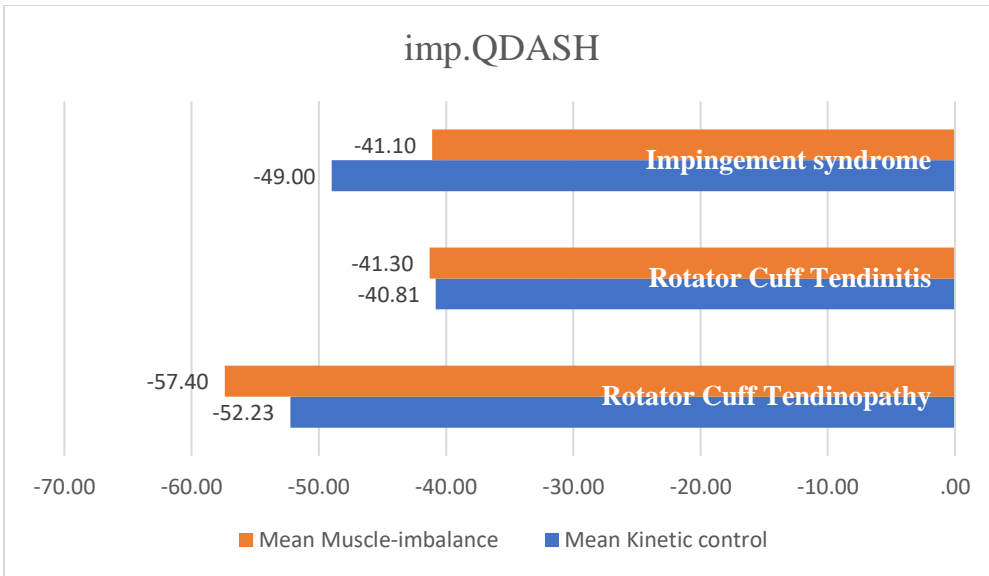


Figure 4-28 QDASH Improvement According to Diagnosis

## 4.6 Discussion

This experimental study focused on the examination of the difference of improvement in patients with rotator cuff dysfunction (impingement, tendonitis, and tendinopathy). Participants in the muscle-imbalance exercise group with an average of **41.55** years, whereas those in the kinetic control group were **42.55** years old. As was predicted in the inclusion criteria age was between 18 and 50. When viewed as an ongoing variable, aging was consistently linked to higher probabilities of rotator cuff illness. Degenerative alterations in the tendon are probably the mechanism via which rotator cuff illness is linked to maturation. The literature has proposed several mechanisms to explain this association, including a decrease in tensile strength, thinning and disorientation of collagen fibers near the cuff insertion, and greater microvascular compromise with age. (Grusky et al., 2022)

It is important to remember that rotator cuff tendinopathy incidence and severity can be greatly influenced by individual variances, gender-wise, Females constituted **65%** of the participants in both groups, while males made up the remaining **35%** which was expected as many studies confirm that tendon health may be influenced by hormonal variables. Studies have looked into how hormones, especially estrogen, may affect the structure and functionality of tendons. that females may be slightly more likely than males to develop rotator cuff tendinopathy. additionally male glenoids may generally be significantly bigger than female glenoids based on biological variances in anatomy. The fact that male skeletal systems are typically bigger might be the cause increase strength and aerobic capacity. (Razmjou et al., 2016)

All of the participants were subjects with Rotator cuff pain or tendinopathy, as we see in **(Figure 4-6)**. both physical demands jobs and office work complain from the RCT symptoms, even though physical demand employees are **16** more than the office employees **14**, also we see that even those who don't work are representing **13** of our sample. This may indicate that for those who work office or physical work, it may be that the issue is dependent on their way of performing their tasks whether it was physical or office rather than work itself, and also may be justifying the 13 of non-workers between the subjects, that despite that they are not working they still complain from the symptoms, which may be related to the use of the phone for longer hours, or they that they use their computer or

any other hobby, the reason behind such phenomena were not art of this study, which may be recommended to be taken into consideration on father studies. this confirms the findings of Beatriz Rodriguez that there were both ergonomic and psychological variables that raised the chance of developing chronic tendinopathies at the shoulder through the workplace. the main risk variables for the majority of tendinous chronic shoulder injuries were weight carrying, age, and awkward postures. An increase in shoulder tendinopathy risk of five times was seen when weights were handled by hand. of (Rodriguez Diez-Caballero et al., 2020), Inverse research of Kuijer that he found that there is poor to very-low quality of evidence of relationship for the occurrence of particular shoulder problems with hand force exertion, hand-arm vibration, psychological job demands, and working with temporary workers. (Kuijer et al., 2012).

When we see the distribution of patients across different BMI categories for the two programs, we discover that patients with excess obesity and those at risk for obesity make up the great majority of participants. The reason for this may be because obese people's lifestyle tends to limit their expected typical range of mobility. for instance, a female who is labeled as pre obesity or obese class 1 and diagnosed with RCT feels discomfort in size of the breast which may cause the shoulder to protract anteriorly and cause the imbalance of shoulder muscles. Additionally, working with extra weight will probably increase the physical load factors around the shoulder joint than in workers of normal weight which is consistent with MachChi's findings in his systematic review that tendinopathy is more common in those who are obese. Greater thickness and decreased stiffness of the tendon were seen in correlation with higher BMI. (MacChi et al., 2020)

Both groups had a significant improvement in flexion and CMT flexion, with no difference between the two groups at follow-up. This can be explained by the fact that inflammation of the shoulder tendons may lead to pain and weakness in different shoulder movements, affecting the flexion movement due to pain that occurs in the supraspinatus muscle which plays a small role in the beginning of flexion. Initiates and facilitates shoulder flexion. Particularly at the beginning of the movement which was confirmed by Wattanaprakornkul in their Electromyographic Study that supraspinatus appears to be one of the muscles that regularly "initiates" flexion, with the anterior translational forces generated during flexion

appearing to be counterbalanced by the rotator cuff muscles. (Wattanaprakornkul et al., 2011)

Both programs were associated with significant differences in the percentage of patients with still positive results in their clinical test, in several orthopedic tests that check the presence of indicators of tendon impingement and tendinopathy. This may be due to other fact that both programs are targeting the same outcomes from different angles, where the kinetic control program is directed toward more controlled movement and less compensation of different muscles, which is translated into different trajectories of the shoulder movement, thus causing rotator cuff dysfunction. and at the same time, the muscle imbalance program is aiming neutralize the imbalance dysfunction in different muscles working as synergists or contralateral groups, the thing that may guarantee less compensatory movement, and further less loss of muscle control during movement. Those two approaches may have contributed to the fact that the majority of the patients in both groups had moved from positive to negative results regarding the clinical orthopedic test of rotator cuff tendinopathy.

The results demonstrated that both kinetic control and muscle-imbalance programs significantly improved shoulder in all ROM directions, so there were no significant differences between groups in different ROM improvements, this may be because when we apply the movement with dysfunctional posture, patient will instead try to reach full ROM adopting compensatory maneuvers of motion that he will perform with deviated posture that could subject the tendon to compression like impingement and could subject the muscle to further overload , and both of these consequences could lead to tendonitis and tendinopathy. at the same time abduction, lateral rotation, and CMT flexion ROM in individuals with rotator cuff dysfunction, have shown more statistically significant improvement in the kinetic control program when compared with muscle imbalance. These findings suggest that focusing on improving movement patterns and neuromuscular control may be a more effective approach than solely addressing muscle imbalances for enhancing shoulder abduction strength in this population which is confirmed by Vila-Diequez in his study that concluded (Vila-Diequez et al., 2023)

All the Static muscle strength improved in all directions in the kinetic control group and the balance imbalance group with ( $P < 0.05$ ), when comparing it to the T2 test within groups, we found that there is a statistically significant difference in abduction, Static muscle strength for the favor of muscle imbalance, the same in medial and lateral rotation, so the muscle imbalance group has improved in Static muscle strength significantly in these three directions which may indicate improvement in muscle strength because the main core direction of this program is based on the fact that it is a muscle strength and muscle balance program. One of the explanations of the improvement in muscle power in both groups could be justified by that the muscle weakness that was present at T1 could have been due to pain, preventing maximum potential of the muscle contraction rather than actual weakness, and as we have seen improvement when pain declined, it could be that this could have helped in showing better strength when doing power assessment at T2. This confirms the findings of Malliou in 2014, who have concluded that Isokinetic exercises were an effective way of restoring muscular imbalance and strength in rotator cuff muscles (Malliou et al, 2014)

When comparing the improvement difference in the three outcome measure that have showed difference of improvement according to diagnosis trying to see which one of them in particular is associated with better improvement and associated with particular program there was no statistical significant difference between using either of two program , however despite the fact that there was no statistically significant difference, there were better improvement in patient diagnosed with impingement syndrome and rotator cuff tendonitis in kinetic control group while rotator cuff tendinopathy improved in muscle imbalance program, regardless to statistical significance , this variation of improving even if it was not statistically significant, it may reflect a potential important clinical significance in a dysfunction that may respond to fractions of millimeters change in trajectory of movement of tendons in the performance of functional movements of the shoulder joint, This is consistent with a study of Elif Turgut when he found that adding scapular stability exercises to shoulder girdle stretching and strengthening exercises generated somewhat

better but probably not clinically meaningful benefits in terms of scapular kinematics. (Turgut et al., 2017)

#### **4.7 Study Limitations**

The researchers note that there were several limitations to this study and suggest that they be taken into consideration in further research:

- We don't apply posture analysis which may be a contributing factor to impingement
- Consider Gender Differences: For items where there are significant differences or marginal significance between genders (e.g., CMT Medial Rotation, CMT Lateral Rotation, Improvement in distance acromion from bed, NRS), further investigation or subgroup analysis may be warranted. It could involve exploring whether these differences are clinically meaningful and considering potential factors contributing to the observed variations.
- Kinetic Control programs often involve intricate movement patterns and specific exercises Patients and practitioners may find the approach complex, leading to a potentially steep learning curve. The program may require a significant time investment, both in terms of training sessions and home exercises. This could be a potential drawback for individuals with busy schedules.

## **5. Chapter Five Conclusion and Recommendation**

### **5.1 Conclusion**

### **5.2 Recommendation**

## 5.1 Conclusion:

Based on the findings of the presented study, the researcher concludes the following:

Static muscle strength improved significantly in both groups, with better improvement in the muscle imbalance group in lateral and medial rotation, and abduction. ROM improved significantly in both programs, with better improvement in abduction, cognitive test flexion, and lateral rotation in the kinetic control program, compared to the improvement in the muscle imbalance program.

The multivariate regression analysis aiming to investigate the effect of personal and anthropometric variables on outcome improvement, in the three above-mentioned ROM outcomes, showed that Being in the kinetic control group and less BMI predicted a better improvement in the CMT flexion. Being in the kinetic control group only predicted better abduction, and finally, the lateral rotation was also predicted by BMI and being in the control group

A potentially clinical but not statistically significant improvement of patients with tendinopathy diagnosis was found in the muscle imbalance group compared to the other 2 diagnoses (impingement and tendonitis) they were better in the kinetic control group

## 5.2 Recommendations

Based on the findings of the presented study, the researcher recommends the following

- This study recommends the use of both the kinetic control and muscle imbalance programs as they were shown to be effective exercise programs for improving shoulder movement in patients with rotator cuff dysfunction.
- Highlight the importance of decreasing obesity as part of the recommendation based on this study's results, since it predicted less CMT and less lateral rotation improvement
- Despite the lack of statistical significance, a potential clinical difference is accepted to recommend the use of muscle imbalance programs with patients with chronic tendinopathy

- Promote using muscle imbalance as part of the management of Muscle RTC weakness in RTC dysfunction.
- **For future studies and researchers**
  - To investigate the epidemiology of the three mentioned diagnoses to be able to prevent underlying causes that may contribute to the prognosis
  - To conduct a longer-term, follow-up with washing out period that would show the sustainability of the results in the different outcomes, as the variation may be represented in the long-term suitability of the results
  - To conduct the study with a third group that may receive a combination of both programs to see if this would augment the effect of the intervention
  - The study might have more power to detect smaller, yet clinically relevant, differences to investigate the effect of the suggested protocol on a larger population with a larger sample size.
  - EMG research is recommended to detect the small difference in improvement of both program
  - Posture analysis in further research could take into consideration and for treatment posture should be one of the major elements of the treatment of any future study as it represents an underlying cause and consequence at the same time.

## Appendix 1: Assessment Sheet



جامعة القدس \ ابو ديس

كلية المهن الصحية

العلاج الطبيعي والتأهيل

نموذج الفحص السريري

تأثير برنامج التمارين المبني على التحكم الحركي مقابل برنامج التمارين التقليدية في التحسن الوظيفي والحركي لمرضى ألم أوتار الكتف في فلسطين / تجربة سريرية عشوائية.

**Participant Name:**

**Participant Code:**

**Date of Signature:**

**Section I: Personal Data**

1. Name of participant: .....
2. Phone number: .....
3. Age: .....
4. Affected side           Rt .....Lt
5. Dominant hand Rt .....Lt
6. place of living
  - A. city
  - B. village
  - C. camp
7. Education level
  - A. None
  - B. Special education
  - C. Primary education
8. Occupation
  - A. Office work
  - B. Physical demand job
  - C. None
9. socioeconomic status
  - A. Single
  - B. Married
  - C. Widowed
  - D. divorced
10. Length \_\_\_\_\_
11. Weight \_\_\_\_\_
12. BMI (Body Mass Index) .....
13. Smoking history
  - A. Yes
  - B. No

**Section II: Medical History**

1. **Diagnosis:**

- A. RC tendinopathy
- B. RC tendonitis
- C. Bursitis
- D. Impingement syndrome

2. **Stage of pain**

- A. acute
- B. chronic
- C. acute on chronic

3. **Diabetes Meletus**    a. Yes    b. No

4. **clinical Test**

**Muscle power**

<b>Muscle power</b>	<b>Baseline</b>	<b>Follow-up</b>
Arm flexion		
Arm abduction		
Arm abduction		
Arm extension		
Medial rotation		
Lateral rotation		

**ROM**

	<b>ROM</b>		<b>CMT ROM</b>	
	<b>Baseline</b>	<b>Follow-up</b>	<b>Baseline</b>	<b>Follow-up</b>
Arm flexion test				
Arm abduction test				
Arm abduction test				
Arm extension test				
Shoulder medial rotation test				
Shoulder lateral rotation test				

**Clinical tests for the affected side**

		Baseline		Follow-up	
		Positive	Negative	Positive	Negative
1	Neer's Test				
2	Hawken's test				
3	Painful Arch sign				
4	Empty can test				
5	Full can test				

**Scapular clinical static test**

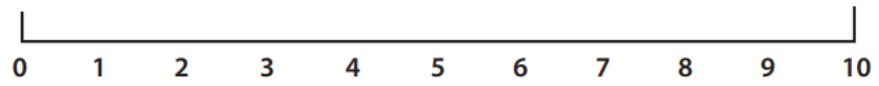
	Baseline		Follow-up	
	Affected	None affected	Affected	None affected
Scapula from spine middle angle				
Distance acromion from bed				

**5. Outcome Measures**

	Baseline	Follow-up
Numeric Rating Scale (NRS)		
Quick DASH questionnaire		
Western Ontario Rotator Cuff Index (WORC)		

## Appendix 2: Numeric Rating Scale

**Numeric Rating Scale (NRS)**



## إعاقات الذراع والكتف واليد (مختصر)

### تعليمات

تستفسر هذه السلسلة من الأسئلة عن الحالات / الأعراض التي تحس بها في ذراعك، أو كتفك، أو يدك وعن مقدرتك على تأدية نشاطات معينة. الرجاء أن تجيب على كل سؤال، بناءً على حالتك خلال الأسبوع الماضي، و ذلك بوضع دائرة حول الرقم المناسب. إذا لم تسنح لك الفرصة لتأدية نشاط ما خلال الأسبوع الماضي، فالرجاء أن تقدر بأفضل ما تستطيع لتختار الجواب الأقرب إلى الدقة. عند إجابتك على الأسئلة، ليس مهماً أي يد أو ذراع تستخدم لتمارس نشاطك سواء كانت اليد المصابة أو السليمة.

الرجاء أن تجيب بناءً على مقدرتك بغض النظر عن الطريقة التي تؤدي بها العمل.



## إعاقات الذراع والكتف واليد (مختصر)

الرجاء أن تقيّم قدرتك على فعل النشاطات التالية خلال الأسبوع الماضي، وذلك بوضع دائرة حول الرقم الذي يقع تحت الجواب المناسب.

غير قادر	بصعوبة شديدة	بصعوبة متوسطة	بصعوبة خفيفة	بلا صعوبة	
5	4	3	2	1	
5	4	3	2	1	1. أن تفتح علبة جديدة أو مُحكمة الإغلاق.
5	4	3	2	1	2. أن تقوم بأعمال المنزل الثقيلة (مثل غسل الحيطان أو إزاحة الأثاث أو سواها من الأشياء الثقيلة).
5	4	3	2	1	3. أن تحمل كيس التسوق أو حقيبة الوثائق.
5	4	3	2	1	4. أن تأسل ظهرك.
5	4	3	2	1	5. أن تستخدم سكيناً لتقطيع الطعام.
5	4	3	2	1	6. أن تقوم بنشاطات ترهيبية تهدل فيها بعض القوة أو الدفع عبر ذراعك أو كتفك أو يدك (مثل لعب التنس أو سواها من الألعاب الأخرى).

لا أبداً على الإطلاق	بشكل طفيف	بشكل متوسط	كثيراً	بشكل بالغ للغاية	
1	2	3	4	5	
1	2	3	4	5	7. خلال الأسبوع الماضي، هل أثرت المشكلة في ذراعك أو كتفك أو يدك بنشاطاتك الاجتماعية العادية مع عائلتك، أو أصدقائك، أو جيرانك، أو زملائك بالمهنة/النادي الاجتماعي؟ (ضع دائرة حول الرقم المناسب)

غير محدود على الإطلاق	بشكل طفيف	بشكل متوسط	محدود جداً	غير قادر	
1	2	3	4	5	
1	2	3	4	5	8. خلال الأسبوع الماضي، هل أثرت المشكلة في ذراعك أو كتفك أو يدك بنشاط عمك أو أي نشاطات يومية اعتيادية أخرى؟ (ضع دائرة حول الرقم المناسب)

الرجاء تقدير شدة العوارض التالية التي أحسست بها خلال الأسبوع الماضي (ضع دائرة حول الرقم المناسب).

لا يوجد	قليلاً	بشكل متوسط	بشدة	بشدة بالغة للغاية	
1	2	3	4	5	
1	2	3	4	5	9. وجع/آلم/عوار في الذراع، أو الكتف، أو اليد.
1	2	3	4	5	10. وخز (مثل وخز الدهليوس و الإبر) في ذراعك، أو كتفك، أو يدك.

لا صعوبة	صعوبة خفيفة	صعوبة متوسطة	صعوبة شديدة	صعوبة بالغة الشدة بحيث لا أقدر على النوم	
1	2	3	4	5	
1	2	3	4	5	11. خلال الأسبوع الماضي، كم كانت صعوبة نومك بسبب الوجع/آلم/عوار في ذراعك، أو كتفك، أو يدك؟ (ضع دائرة حول الرقم المناسب)

إعاقات الذراع والكتف واليد (مختصر): إجمالي درجات الإعاقات / الأعراض = [(مجموع عدد الإجابات) - 1] × 25 ، حيث (العدد) يساوي عدد الإجابات المكتمة.

لا يمكن حساب إجمالي الدرجات في مقياس إعاقات الذراع والكتف واليد (مختصر) إذا تجاوز عدد البنود الناقصة بنداً واحداً.



**WORK**

11. How much difficulty do you experience in daily activities about the house or yard? \_\_\_\_\_  
No difficulty Extreme difficulty

12. How much difficulty do you experience working above your head? \_\_\_\_\_  
No difficulty Extreme difficulty

13. How much do you use your uninvolved arm to compensate for your injured one? \_\_\_\_\_  
Not at all Constant

14. How much difficulty do you experience lifting heavy objects from the ground or below shoulder level? \_\_\_\_\_  
No difficulty Extreme difficulty

**LIFESTYLE**

15. How much difficulty do you have sleeping because of our shoulder? \_\_\_\_\_  
No difficulty Extreme difficulty

16. How much difficulty have you experienced with styling your hair because of your shoulder? \_\_\_\_\_  
No difficulty Extreme difficulty

17. How much difficulty do you have "roughhousing or horsing around" with family and friends? \_\_\_\_\_  
No difficulty Extreme difficulty

18. How much difficulty do you have dressing or undressing? \_\_\_\_\_  
No difficulty Extreme difficulty



**EMOTIONS**


19. How much frustration do you feel because of your shoulder? \_\_\_\_\_  
No frustration Extreme frustration

20. How "down in the dumps" or depressed do you feel because of your shoulder? \_\_\_\_\_  
None Extreme


21. How worried or concerned are you about the effect of your shoulder on you occupation or work? \_\_\_\_\_  
Not at all Extremely concerned


## Appendix 5: Muscle-Imbalance-Based exercise Group


<b><u>Warm-up exercise</u></b>			
<b>Exercise</b>	<b>Application</b>	<b>Protocol</b>	
<p><b>High Knee March in Place</b></p>	<p><b>Starting Position:</b> Stand with your feet hip-width apart. Ensure your posture is upright, with your spine straight and shoulders relaxed.</p> <p><b>Movement:</b> While maintaining the shoulder in neutral position, lift your left knee towards your chest. This involves flexing your hip.</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p>	
<p><b>Shoulder roll</b></p>	<p><b>Starting Position:</b> Stand or sit with your feet shoulder-width apart. Keep your back straight, maintaining a neutral spine whether standing or sitting. Allow your arms to rest naturally at your sides.</p> <p><b>Movement:</b> Begin by gently rolling your shoulders forward in a circular motion. Lift your shoulders towards your ears, then roll them forward and down in a continuous circle</p> <p><b>Instructions:</b> As you roll your shoulders forward, focus on the smooth, controlled movement. Continue the circular motion, ensuring a continuous rise and fall of the shoulders. Maintain the straightness of your back throughout the entire exercise. Avoid slouching or rounding your shoulders.</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p>	

<p><b>Pendulum circles</b> (Deltoids, supraspinatus, infraspinatus, subscapularis)</p>	<p><b>Starting Position:</b> Stand with your feet in a running position, one foot slightly in front of the other for balance. Lean forward at the hips, allowing them to flex slightly. Maintain a comfortable stance.</p> <p><b>Arm Positioning.</b> Relax the arm on the painful side, letting it hang straight down. Extend your fingertips towards the floor.</p> <p><b>Movement:</b> Begin to move your arm in small circles, drawing a circle in the air with your fingertips. Keep the movement controlled and gentle, avoiding any sudden or jerky motions.</p> <p><b>Instructions:</b> Focus on keeping the arm as relaxed as possible throughout the circles. Ensure that your neck stays aligned with your spine. Avoid tilting or rotating your head excessively.</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	
--	---	---	---


**Cool down exercise**


Exercise	Application	Protocol	
<p><b>Crossover Arm Stretch</b>  (Posterior deltoid)</p>	<p><b>Starting Position:</b> Stand or sit comfortably with a straight back.</p> <p><b>Movement:</b> Cross your afflicted arm (the one you want to stretch) in front of your body. Hold your</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	



	<p>afflicted elbow with the opposite hand. Gently flex the bent arm, bringing your hand closer to your chest. Continue flexing until you feel a gentle stretch at the back of your shoulder. This stretch should be felt in the crossed arm. Hold the stretched position for 30 seconds. Take a moment to feel the stretch and breathe deeply.</p>		
<p><b>Anterior shoulder stretching</b></p>	<p><b>Starting Position:</b> Find a doorway or stand in a corner of a room. Raise your arms to shoulder height.</p> <p><b>Movement:</b> Place each hand on either side of the doorway or in the corner, with your palms and forearms making contact with the wall or door. Step one foot forward and one foot back to create a stable stance. Lean your body forward slightly, allowing your chest to move toward the wall or into the corner.</p> <p><b>Instructions:</b> You should feel a gentle stretch across your chest and the front of your shoulders. Hold the stretch for a duration that is</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	 <p style="text-align: center;"><b>Start</b>                      <b>End</b></p>



	comfortable, typically around 15-30 seconds.		
<b>Neck muscle stretching</b>	<p><b>Starting Position:</b> Stand with your feet shoulder-width apart. Keep your shoulders relaxed and down, maintaining a straight posture.</p> <p><b>Movement:</b> Begin by gently pulling your left ear towards your left shoulder. Avoid lifting the shoulder; instead, focus on bringing the ear closer to the shoulder. return to the starting position, and then gently pull your right ear towards your right shoulder.</p> <p><b>Instructions:</b> Hold the stretch for a gentle sensation along the right side of your neck.</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	 <p style="text-align: center;"><b>Start                      End</b></p>

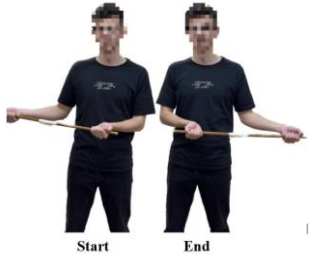
**1<sup>st</sup> -2<sup>nd</sup> week**

	<b>Exercise</b>	<b>Application</b>	<b>Protocol</b>	
<b>Major exercise</b>	<b>Flexion wall slide</b>	<p><b>Starting Position:</b> Stand facing a wall with your feet separated, one in front of the other. The front foot should be closer to the wall, and the</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	

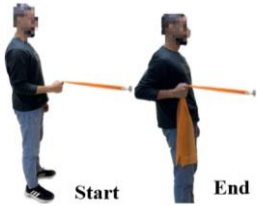
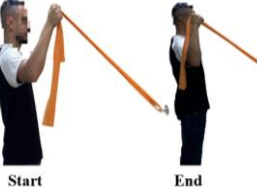
		<p>back foot should be farther away.</p> <p><b>Movement:</b> Place one hand on the wall at about shoulder height. Shift your weight onto the front leg while keeping the back leg straight. Slide your hand up the wall, reaching as high as comfortably possible. Focus on lengthening through the side of your body</p> <p><b>Instructions:</b> Feel the stretch along the side of your body, from your hip to your fingertips. Hold the stretched position for about 15-30 seconds or as long as comfortable. Slowly slide your hand back down the wall and return to the starting position.</p>		
	<p><b>Posture exercises</b></p>	<p><b>Starting Position:</b> Stand with your feet hip-width apart.</p> <p><b>Movement:</b> Hands on Hips - Forward Leaning Stretch Place your hands on your hips , Inhale and elongate your spine. Exhale and gently lean forward at your hips, keeping your back straight.</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p>	


		<p>Hold this forward-leaning stretch for 30 seconds.</p>		
	<p><b>Cat-Cow Stretch</b></p>	<p><b>Starting Position:</b> Begin by kneeling on the ground with your hands placed directly beneath your shoulders and your knees beneath your hips. Ensure your wrists are aligned with your shoulders, and your fingers are spread for stability.</p> <p><b>Movement:</b> Inhale deeply and gradually arch your back upward, starting from your tailbone. Allow your spine to round, gently tuck your chin towards your chest, and engage your abdominal muscles to draw your belly button towards your spine. Continue the arching motion until your back is fully rounded, resembling a cat stretching. Hold the Cat posture for 30 seconds, maintaining the rounded position.</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	
	<p><b>Scapula Setting (Middle trapezius, serratus)</b></p>	<p><b>Starting Position:</b> Begin by lying on your stomach with your arms extended by your sides, and palms facing down.</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	

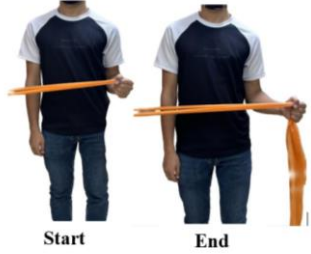
		<p><b>Movement:</b> Focus on bringing your shoulder blades together as much as possible. Simultaneously, try to draw your shoulder blades down towards your lower back. Hold the fully retracted and downward position for a moment, feeling the engagement between your shoulder blades.</p>		
	<p><b>Active assisted range of motion using a cane</b></p>	<p><b>Starting Position:</b> Stand or lie down in a comfortable position. Hold a cane firmly in both hands. The cane will serve as a guide and support for the affected arm.</p> <p><b>Movement:</b> Begin by lifting both arms simultaneously, using the unaffected arm to guide the movement of the affected arm. Lift the arms to a comfortable height, considering the range of motion of the affected arm.</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	
	<p><b>Passive Internal Rotation (Supraspinatus)</b></p>	<p><b>Starting Position:</b> Stand or sit comfortably with an upright posture. Hold a stick or rod behind your back with two hands</p> <p><b>Movement:</b> Begin moving the stick horizontally across your back by gently pulling</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	

		<p>with the hand that is holding the lower end. Allow the stick to guide your arms and shoulders, moving them horizontally. Continue the horizontal movement until you feel a passive stretch in your shoulder. Stop at the point where you feel a pull but not discomfort.</p>		
	<p><b>Passive External Rotation</b> (Infraspinatus, teres minor)</p>	<p><b>Starting Position:</b> Stand or sit comfortably with an upright posture. Hold a stick or rod with one hand, gripping one end, and extend the arm horizontally. With the other hand, grasp the opposite end of the stick, keeping it in place.</p> <p><b>Movement:</b> Keep the elbow of the extended shoulder against your side, maintaining a bent-arm position. Push the stick horizontally with the hand that is holding the end, extending the arm. Continue pushing until you feel a gentle pull in the shoulder, avoiding any pain or discomfort. Hold the stretched position for 30 seconds, focusing on feeling the stretch without pushing to the point of pain.</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks</p>	


3<sup>rd</sup> -4<sup>th</sup> week

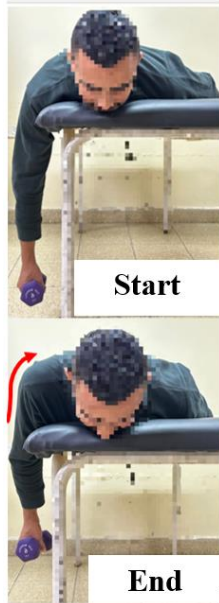

3 <sup>rd</sup> -4 <sup>th</sup> week				
	Exercise	Application	Protocol	
<b>Major exercise</b>	<p><b>Standing Row</b></p> <p>(Middle and lower trapezius)</p>	<p><b>Starting Position:</b> Stand facing the anchored point, with your feet shoulder-width apart. Hold the TheraBand with one hand, keeping your elbow bent at approximately 90 degrees and your arm close to your side. Position your feet in a way that provides stability and balance.</p> <p><b>Movement:</b> Begin the exercise by pulling your elbow straight back while keeping your arm close to your side. Focus on squeezing your shoulder blades together as you pull. Fully extend your elbow back, feeling the contraction in your back muscles. Slowly release the tension on the band and return to the starting position.</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p> <p><b>TheraBand color :</b> Orange</p>	
	<p><b>External Rotation with Arm Abducted 90°</b></p> <p>(Infraspinatus and teres minor)</p>	<p><b>Starting Position:</b> Stand facing the anchored point, maintaining a good distance for tension, Hold the looped band in one hand, allowing your arm to be bent at approximately 90 degrees,</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p> <p><b>TheraBand color :</b> Orange</p>	



		<p>and keep your elbow close to your side.</p> <p><b>Movement:</b> With your arm close to your side, slowly pull your elbow straight back. Focus on engaging your back muscles, particularly the muscles between your shoulder blades. Keep a controlled pace, ensuring a smooth and deliberate movement. Fully extend your elbow backward, feeling the contraction in your back muscles.</p>		
	<p><b>Internal Rotation</b> (Pectoralis, subscapularis)</p>	<p><b>Starting Position:</b> Stand facing the anchored point, maintaining a distance that creates tension in the band. Grip the looped band with both hands, holding it at chest level.</p> <p><b>Movement:</b> Position your elbows at your sides with your hands holding the band. Keep your elbows tucked in as you bring one arm across your body in a horizontal motion. The movement is similar to pulling the band across your chest. Allow your arm to reach across your body, feeling a stretch in your chest and engaging the</p>	<p><b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks <b>TheraBand color :</b> Orange</p>	

		muscles between your shoulder blades.		
	<b>External Rotation</b>  (Infraspinatus, teres minor, posterior deltoid)	<b>Starting Position:</b> Stand facing the anchored point, maintaining a distance to create tension in the band, Grip the looped band with one hand, holding it at chest level. Flex your elbow at your side, with your forearm parallel to the ground.  <b>Movement:</b> While maintaining your elbow close to your side, slowly extend your arm straight outward by pushing the band down, Focus on using your triceps to control the movement and fully extend your arm. Fully extend your arm, feeling the contraction in your triceps.	<b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks <b>TheraBand color :</b> Orange	

**5<sup>th</sup> -6<sup>th</sup> week**

	Exercise	Application	Protocol	
<b>Major exercise</b>	<b>Upright Row</b>  (Middle and posterior deltoid, supraspinatus, middle trapezius)	<b>Starting Position:</b> Lean forward till your hand comes into contact with the bench and takes up your weight. relax your knee down on a bench or chair.  <b>Movement:</b> With the palm facing in the direction of your body, the other hand is by your side.  <b>Instructions:</b> As you gently lift your arm until it is parallel to the floor and your hand at shoulder height,	<b>Repetition:</b> 10 R <b>Bouts</b> 2 bouts <b>Frequency:</b> 3 Days /weeks <b>Dumbbells :</b> 1 kg	

		rotate your hand to the thumbs-up position.		
	<p><b>Scapular Retraction/ Protraction</b></p> <p>(Middle trapezius, serratus)</p>	<p><b>Starting Position:</b> Lying on your stomach, lean your afflicted shoulder over the side of a table or bed.</p> <p><b>Movement:</b> As you press as far to the other opposite side of your shoulder blade as you can, gradually elevate the weight while keeping your elbow straight.</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p> <p><b>Dumbbells :</b> 1 kg</p>	 <p>Start</p> <p>End</p>
	<p><b>Bent-Over Horizontal Abduction</b></p> <p>(Middle and lower trapezius, Infraspinatus, teres minor, posterior deltoid)</p>	<p><b>Starting Position:</b> Lay on your stomach with your afflicted arm hanging over the side of the bed.</p> <p><b>Movement:</b> Gradually raise your arm to eye level, keep it straight.</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p> <p><b>Dumbbells :</b> 1 kg</p>	 <p>Start</p> <p>End</p>

	<p><b>External Rotation</b></p> <p>(Infraspinatus, posterior deltoid, teres minor)</p>	<p><b>Starting Position</b> :Using your unaffected arm supporting your head, lay on your side on a flat, steady surface.</p> <p><b>Movement</b> :Hold your injured arm against your side as shown, with your elbow bent at a 90° angle. bring the weight up to a vertical position, carefully rotate your arm at the shoulder while keeping your elbow near to your side.</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p> <p><b>Dumbbells :</b> 1 kg</p>	
	<p><b>Internal Rotation</b></p> <p>(Subscapularis, teres major)</p>	<p><b>Starting Position:</b> lie on flat and firmly on the side of your affected shoulder. Place a folded piece of pillow under your head to maintain a straight back. <b>Movement:</b> Hold your injured arm against the side as shown, keeping your elbow flexed at a 90° angle. Rotate your arm at the shoulder gradually to bring the weight up to a vertical position while keeping your elbow bent toward your body.</p>	<p><b>Repetition:</b> 10 R</p> <p><b>Bouts</b> 2 bouts</p> <p><b>Frequency:</b> 3 Days /weeks</p> <p><b>Dumbbells :</b> 1 kg</p>	

## Appendix 6: Arabic Muscle-Imbalance-Based Exercise Group

تمارين الاحماء لمرضى الم الكتف لكافة الاسبوع:

التمرين	التعليمات	العدد
الجري بالمكان	قف بشكل مستقيم، حرك اقدمك للأعلى مع مباعدة قدميك بعرض الورك ومرفقك جانباً.	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعياً
لف الكتف	قم بتدوير الكتفين إلى الأمام برفق مع رفعهما وخفضهما في دائرة مستمرة حافظ على استقامة ظهرك سواء كنت واقفاً أو جالساً وحافظ على ذراعك على جانبيك.	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعياً
حلقات البندول	اثن وركبك وانحن إلى الأمام، علق الذراع المصابة للأسفل بشكل مستقيم، واتركها تسترخي ارسم دائرة صغيرة في الهواء بأطراف أصابعك أثناء تحريك ذراعك في دائرة. حافظ على استرخاء ذراعك قدر الإمكان ورفقتك بما يتماشى مع الدوران.	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعياً

تمارين الاسترخاء لمرضى الكتف لكافة الاسبوع

التمرين	التعليمات	العدد
تمرين استطالة عضلات الكتف الخلفية	اعبر بالذراع المصابة أمام الجسد نحو الكتف الاخر. أمسك الكوع بذراعك الأخرى. عندما تشعر بالشد في الجزء الخلفي من الكتف، قم بدفع الذراع المثنية برفق. ثم التوقف لمدة 10 ثوانٍ في كل شدة ..	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعيا
تمرين استطالة عضلات الكتف الأمامية	ضع يديك على مستوى الكتف على جانبي الباب أو في زاوية الغرفة. انحن للأمام نحو الباب أو الركن وثبت لمدة 10 ثوانٍ في كل شدة.	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعيا
استطالة عضلات الرقبة	قف مع كتفيك للأسفل، اسحب أذنك اليسرى برفق نحو كتفك الأيسر وبالعكس أذنك اليمنى برفق نحو كتفك الأيمن.	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعيا

تمارين الكتف الاساسية للأسبوع الأول والثاني

التمرين	التعليمات	العدد
رفع اليد على الحائط	ضع يديك على الحائط وقف مع وضع قدميك واحدة في الأمام والأخرى خلف، حرك يديك بهدوء على الحائط للأعلى، انقل الوزن إلى الساق الأمامية أثناء تحريك اليد لأعلى الحائط.	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعيا
تمرين القوام	ضع يديك على الوركين، وانحن للخلف، وثبت مع استراحة مدتها 10 ثوانٍ بين كل تمرين.	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعيا
تمرين القطة	يتم التمرين من خلال الركوع على الأرض من خلال الركبتين واليدين مفردتين والظهر مفرد تماما ثم اتخاذ وضعية القطة من خلال تقويس الظهر لأعلى ببطء، إلى أن يصبح الظهر مستديرا تماما، مع التنفس لمدة 30 ثانية ثم بعد ذلك قم بالزفير ببطء وإعادة تقويس الظهر لأسفل ببطء والثبيت لمدة 30 ثانية	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعيا
تقوية عضلات لوح الكتف	استلق على بطنك وذراعيك من جانبيك بقدر ما تستطيع، اجلب لوح كتفك معًا باتجاه بعضهما البعض قدر الإمكان ثبت وابق عليه لمدة 10 ثوان	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعيا
رفع العصا للأعلى	من وضعية الوقوف أو الجلوس أمسك العصا بكلتا يديك، ارفع الذراعين للأعلى باستخدام الذراع السليمة لتوجيه الذراع المصابة.	تكرار: 10 تكرارات الجولات: 3 مرات في اليوم معدل: 3 مرات أسبوعيا

 <p>Start End</p>	<p><b>تكرار:</b> 10 تكرارات <b>الجولات:</b> 3 مرات في اليوم <b>معدل:</b> 3 مرات أسبوعيا</p>	<p>من وضعية الوقوف او الجلوس امسك العصا بشكل افقي وثبت يديك بجانب وسطك وقم بتحريك العصا بشكل افقي لليمين واليسار بشكل مريح.</p>	<p>إزاحة العصا للجانب من الامام</p>
 <p>Start End</p>	<p><b>تكرار:</b> 10 تكرارات <b>الجولات:</b> 3 مرات في اليوم <b>معدل:</b> 3 مرات أسبوعيا</p>	<p>من وضعية الوقوف امسك العصا خلف ظهرك وقم بتحريك العصا لليمين واليسار بشكل مريح</p>	<p>إزاحة العصا للجانب من الخلف</p>

### تمارين الكتف الاساسية للأسبوع الثالث والرابع

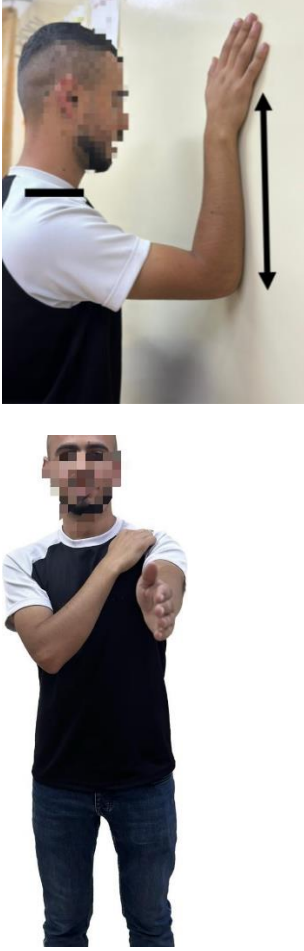
	العدد	التعليمات	التمرين
 <p>Start End</p>	<p><b>تكرار:</b> 10 تكرارات <b>الجولات:</b> 3 مرات في اليوم <b>معدل:</b> 3 مرات أسبوعيا</p>	<p>قم بربط الشريط المطاطي حول مقبض باب مغلق وامسك الشريط باليد المصابة وثبت الكوع بزاوية 90 درجة بحيث تكون اليد المصابة هي القريبة من الباب وقم بشد الشريط باتجاه جسمك بلطف وثبت لمدة خمس ثواني واعادها بلطف</p>	<p>دوران الكتف للدخل</p>
 <p>Start End</p>	<p><b>تكرار:</b> 10 تكرارات <b>الجولات:</b> 3 مرات في اليوم <b>معدل:</b> 3 مرات أسبوعيا</p>	<p>قم بربط الشريط المطاطي حول مقبض باب مغلق وامسك الشريط باليد المصابة وثبت الكوع بزاوية 90 درجة بحيث تكون اليد المصابة هي البعيدة عن الباب وقم بشد الشريط مبتعدا عن جسمك بلطف وثبت لمدة خمس ثواني واعادها بلطف</p>	<p>دوران الكتف للخارج</p>
 <p>Start End</p>	<p><b>تكرار:</b> 10 تكرارات <b>الجولات:</b> 3 مرات في اليوم <b>معدل:</b> 3 مرات أسبوعيا</p>	<p>قم بربط الشريط المطاطي حول مقبض الباب اجعل مسافة 3 اقدام بينك وبين الباب، امسك بالشريط بحيث يكون ذراعك بالقرب منك وقم بسحب الكوع ببطء ثم ارجع لوضعية البداية بهدوء ملاحظة: حافظ على استقامة ظهرك اثناء التمرين</p>	<p>تقوية عضلات الكتف</p>
 <p>Start End</p>	<p><b>تكرار:</b> 10 تكرارات <b>الجولات:</b> 3 مرات في اليوم <b>معدل:</b> 3 مرات أسبوعيا</p>	<p>قم بربط الشريط المطاطي حول مقبض الباب اجعل مسافة 3 اقدام بينك وبين الباب، امسك بالشريط المطاطي واسحبه للأعلى مع ابقاء الكوع بزاوية 90 درجة</p>	<p>تقوية عضلات لوح الكتف</p>


تمارين الأسبوع الخامس والسادس

	العدد	التعليمات	التمرين
 <p style="text-align: center;">Start</p>  <p style="text-align: center;">End</p>	<p><b>تكرار:</b> 10 تكرارات <b>الجولات:</b> 3 مرات في اليوم <b>معدل:</b> 3 مرات أسبوعيا <b>الوزن:</b> 1- كيلو</p>	<p>قف واثني وركبك وانحنِ إلى الأمام، علق الذراع المصابة للأسفل بشكل مستقيم ممسكا الثقل المحدد فيها قم برفعها للأعلى بشكل مستقيم بهدوء</p>	<p><b>الرفع واليد مستقيمة باستخدام الوزن</b></p>
 <p style="text-align: center;">Start</p>  <p style="text-align: center;">End</p>	<p><b>تكرار:</b> 10 تكرارات <b>الجولات:</b> 3 مرات في اليوم <b>معدل:</b> 3 مرات أسبوعيا <b>الوزن:</b> 1- كيلو</p>	<p>قم بالاستلقاء على البطن ممسكا الوزن باليد واسحب لوحة الكتف بدون رفع اليد او ثنيها كرر التمرين بهدوء</p>	<p><b>تقوية عضلات لوح الكتف باستخدام اوزان</b></p>


 <p>Start</p> <p>End</p>	<p><b>تكرار:</b> 10 تكرارات</p> <p><b>الجولات:</b> 3 مرات في اليوم</p> <p><b>معدل:</b> 3 مرات أسبوعيا</p> <p><b>الوزن:</b> 1- كيلو</p>	<p>قم بالنوم على البطن كما هو بالصورة امسك الوزن مع إبقاء الأبهام يشير الى الامام ثم ارفق اليد وهي مستقيمة ببطء مبتعدة عن السرير الى ان تصل الى مستوى الجسم واعدها للأسفل بهدوء وكرر هذه العملية</p>	<p><b>النوم على البطن</b></p>
 <p>Start</p> <p>End</p>	<p><b>تكرار:</b> 10 تكرارات</p> <p><b>الجولات:</b> 3 مرات في اليوم</p> <p><b>معدل:</b> 3 مرات أسبوعيا</p> <p><b>الوزن:</b> 1- كيلو</p>	<p>قم بالنوم على الجانب السليم واجعل يدك المصابة بجانب جسمك كما هو مبين بالصورة امسك الوزن باليد المصابة وارفع ببطء وانزل وكرر التمرين بهدوء</p>	<p><b>النوم على الجانب</b></p>
 <p>Start</p> <p>End</p>	<p><b>تكرار:</b> 10 تكرارات</p> <p><b>الجولات:</b> 3 مرات في اليوم</p> <p><b>معدل:</b> 3 مرات أسبوعيا</p> <p><b>الوزن:</b> 1- كيلو</p>	<p>قم بالنوم على الجانب المصاب وامسك الوزن كما هو مبين بالصورة وارفع الوزن وانزله ببطء وكرر التمرين</p>	<p><b>النوم على الجهة المصابة</b></p>

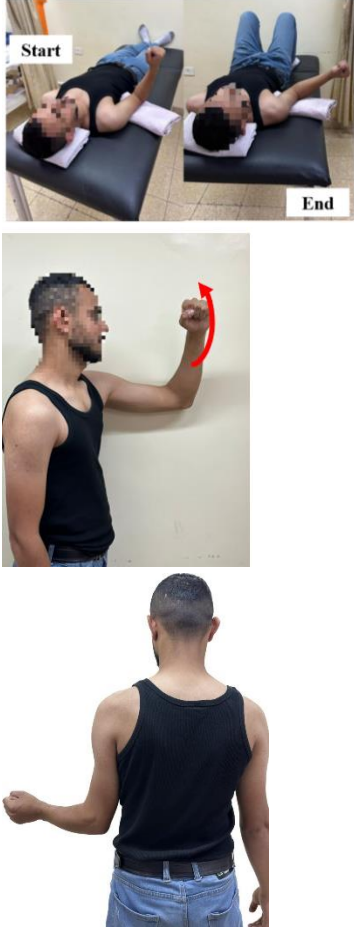
## Appendix 7: Exercises Kinetic control program:


Exercise	Application	Protocol	
<p>Dissociate flexion to 90°</p>	<p><b>Starting Position:</b> Stand with feet shoulder-width apart for stability. Maintain a straight back and relaxed shoulders.</p> <p><b>Positioning:</b> Allow the affected arm to rest by your side, with the palm facing in towards your body (neutral rotation). Ensure the scapula (shoulder blade) is in a neutral position – not excessively protracted or retracted.</p> <p><b>Movement:</b> Lift your affected arm in front of you, maintaining a neutral scapula. Continue the movement until your arm is extended straight in front of you at shoulder level, reaching a 90° angle of shoulder flexion.</p> <p><b>Instructions</b> Keep your scapula in a neutral position throughout the movement. Avoid</p>	<p><b>Progression</b></p> <ol style="list-style-type: none"> <li>1. Done while standing with the elbow bent to shorten the arm lever and lessen the strain and the scapula propped up by leaning against a wall.</li> <li>2. As control increases, self-palpation can be used to complete arm flexion across a partial range without assistance.</li> <li>3. As control increased, it advanced across the whole benchmark range while maintaining a straight elbow with kinesthetic, aural, and visual input.</li> </ol>	

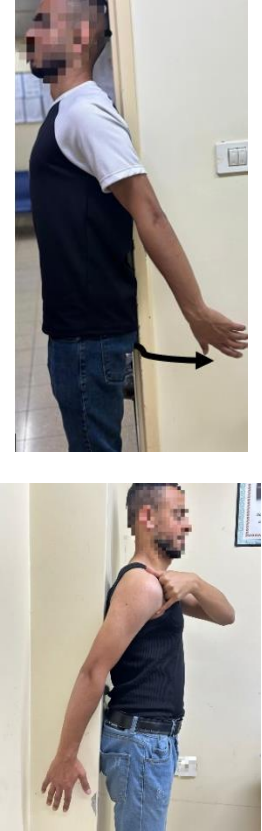
	<p>shrugging your shoulder or allowing your shoulder blade to excessively move. Hold the lifted position for a moment, feeling the contraction in your shoulder muscles. and slowly lower your arm back to the starting position by your side. Maintain control throughout the descent, resisting the pull of gravity.</p>		
<p>Dissociate abduction to 90°+ rotation timing</p>	<p><b>Starting Position:</b> Stand with your feet shoulder-width apart for stability.</p> <p>Keep your back straight and your shoulders relaxed.</p> <p><b>Positioning:</b> Place your affected arm by your side with your palm facing toward your body</p> <p>Ensure that your scapula (shoulder blade) is in a neutral position, neither excessively protracted nor retracted.</p> <p><b>Movement:</b> Slowly lift your arm in the scapular</p>	<p><b>Progression</b></p> <ol style="list-style-type: none"> <li>1. Done while standing with the elbow bent to shorten the arm lever and lessen the strain and the scapula propped up by leaning against a wall.</li> <li>2. As control increases, self-palpation can be used to complete arm flexion across a partial range without assistance.</li> </ol> <ol style="list-style-type: none"> <li>1. As control increased, it advanced across the whole benchmark range while maintaining a straight elbow with kinesthetic,</li> </ol>	

	<p>plane, leading with your thumb, to shoulder level. Aim for a 90° angle of shoulder abduction. This is the point where your arm is straight out to the side, parallel to the ground.</p> <p><b>Instructions</b> Keep your scapula in a neutral position throughout the movement. Avoid shrugging your shoulder or allowing your shoulder blade to excessively move. Hold the lifted position for a moment, feeling the contraction in your shoulder muscles. and slowly lower your arm back to the starting position by your side. Maintain control throughout the descent, resisting the pull of gravity.</p>	<p>aural, and visual input.</p>	
--	--	---------------------------------	--

<p>Dissociate medial rotation – abducted 90°</p>	<p><b>Starting Position:</b> Stand with feet shoulder-width apart for stability. Maintain a straight back and relaxed shoulders.</p> <p><b>Positioning:</b> Raise the patient's arm to 90° abduction, with the hand pointing toward the ceiling. Ensure the humerus is supported in the plane of the scapula.</p> <p><b>Movement:</b> Slowly and gently rotate the patient's forearm (medial rotation). The therapist should guide this movement to avoid excessive range.</p> <p><b>Instructions</b> Keep your scapula in a neutral position throughout the movement. Avoid shrugging your shoulder or allowing your shoulder blade to excessively move. Hold the lifted position for a moment, feeling the contraction in your shoulder muscles. and slowly lower your arm back to the starting position by your side.</p>	<p><b>Progression</b></p> <ol style="list-style-type: none"> <li>1. Performed while standing, with the elbow bent to lower the arm lever length and reduce weight, and the scapula supported by leaning against a wall.</li> <li>2. As control improves, arm flexion is performed unsupported across the range that is well-controlled by self-palpation.</li> <li>3. Using kinesthetic, auditory, and visual cues, the elbow stayed straight across the benchmark range as control grew.</li> </ol>	
--	--	--	---

	<p>Maintain control throughout the descent, resisting the pull of gravity</p>		
<p>Dissociate lateral rotation – standing arm by side</p>	<p><b>Starting Position:</b> Begin with the patient lying on their back in a supine position on a treatment table.</p> <p><b>Positioning:</b> Position the elbow of the affected arm by the side in the scapular plane (axillary line) with the elbow flexed to 90°. The hand should point forwards, palm in towards the body.</p> <p><b>Movement:</b> The person is instructed to turn the arm out into lateral rotation without compensating at the scapula or glenohumeral joint Aim for a total of 45° of active lateral rotation, ensuring that the movement is controlled and does not cause discomfort.</p> <p><b>Instructions</b> Keep your scapula in a neutral position throughout the</p>	<p><b>Progression</b></p> <ol style="list-style-type: none"> <li>1. Initial correction can be performed lying in supine with the arm supported by the side.</li> <li>2. Correction with wall support</li> <li>3. Correction of partial range lateral rotation with unsupported shoulder girdle</li> </ol>	

	<p>movement. Avoid shrugging your shoulder or allowing your shoulder blade to excessively move. Hold the lifted position for a moment, feeling the contraction in your shoulder muscles. and slowly lower your arm back to the starting position by your side. Maintain control throughout the descent, resisting the pull of gravity</p>		
<p>Dissociate extension to 15° + rotation timing</p>	<p><b>Starting Position:</b> Stand with your feet shoulder-width apart for stability. Allow your arm to rest by your side with your palm facing toward your body (neutral rotation).</p> <p><b>Positioning:</b> Ensure your scapula (shoulder blade) is in a neutral position, neither excessively protracted nor retracted. Keep your glenohumeral joint (shoulder joint) in a neutral position.</p>	<p><b>Progression</b></p> <ol style="list-style-type: none"> <li>1. To minimize the arm lever length and load, the initial adjustment can be made while standing with the elbow flexed and the scapula stabilized by leaning against a wall's corner.</li> <li>2. As control gets better, the arm extension is carried out over the portion of the range that self-palpation can effectively manage without assistance.</li> <li>3. The individual learns to do the task of extending</li> </ol>	

	<p><b>Movement:</b> slowly move your arm backward, extending it behind you. Aim for a controlled movement, limiting the range to 15° of shoulder extension. Hold the extended position for a brief moment, feeling the stretch in the back of your shoulder.</p> <p><b>Instructions</b> Keep your scapula in a neutral position throughout the movement. Avoid shrugging your shoulder or allowing your shoulder blade to excessively move. Hold the lifted position for a moment, feeling the contraction in your shoulder muscles. and slowly lower your arm back to the starting position by your side. Maintain control throughout the descent, resisting the pull of gravity</p>	<p>the glenohumeral joint from 0 to 15° without scapula movement or glenohumeral translation using visual, aural, and kinesthetic cues.</p>	
--	---	---	--

## Appendix 8: Arabic Kinetic control program:

التمرين	التعليمات	العدد
الثني للأمام ل 90 درجة	يقف المريض مع وضع ذراعه على الحائط وترك لوح الكتف في الوضع الطبيعي دون الم (راحة اليد للداخل)، يُطلب من المريض إبقاء لوح الكتف في الوضع المحايد ورفع الذراع خلال 90 درجة من ثني الكتف الأمامي وخفض الذراع مرة أخرى. عند التحسن يقوم المريض بعمل التمرين دون وضع يده على الحائط من الممكن ان يقوم به من خلال وضع يده السليمة على الكتف المصاب والنظر الى المرأة	تكرار: معدل دقيقتين الجولات: مرتين يوميا معدل: 3 مرات أسبوعيا
ثني الكتف الجانبي ل 90 درجة	يقف المريض مع وضع ذراعه على الحائط جانبيا وترك لوح الكتف في الوضع الطبيعي دون الم (راحة اليد للداخل)، يُطلب من المريض رفع ذراعه من خلال زاوية 90 درجة لإبعاد الكتف (في مستوى لوح الكتف)، والحفاظ على لوح الكتف في الوضع المحايد، ثم إنزال ذراعه مرة أخرى إلى الجانب. عند التحسن يقوم المريض بعمل التمرين دون وضع يده على الحائط من الممكن ان يقوم به من خلال وضع يده السليمة على الكتف المصاب والنظر الى المرأة	تكرار: معدل دقيقتين الجولات: مرتين يوميا معدل: 3 مرات أسبوعيا
دوران الكتف الداخلي	في وضعية الوقوف، يضع المريض يده على الحائط مع ثني الكتف بمقدار 90 درجة. خلال هذه التقنية ويقوم المريض بدوران كتفه الداخلي بمقدار 60 درجة عند التحسن يقوم المريض بعمل التمرين دون وضع يده على الحائط من الممكن ان يقوم به من خلال وضع يده السليمة على الكتف المصاب والنظر الى المرأة	تكرار: معدل دقيقتين الجولات: مرتين يوميا معدل: 3 مرات أسبوعيا
دوران الكتف الجانبي	في البداية من وضعية الاستلقاء على السرير نضع بشكير تحت يد المريض لإبقاء الكتف في الوضع الطبيعي وثني الكوع بمقدار 90 درجة مع إبقاء اليد بجانب الجسم على طول الخط الأبطي يتم توجيه الشخص لتدوير ذراعه إلى الجانب	تكرار: معدل دقيقتين الجولات: مرتين يوميا معدل: 3 مرات أسبوعيا

		<p>بمقدار 45 درجة مع الحفاظ على وضعية لوح الكتف المحايدة. مع إبقاء الكتف في الوضع الطبيعي ولا ينبغي أن يميل لوح الكتف إلى الأمام، أو يدور إلى الأسفل، أو يتراجع.</p> <p>عند التحسن يقوم المريض بعمل التمرين من وضعية الوقوف ووضع يده عبي الحائط بمقدار 90 درجة و بعد التحسن يقوم المريض بعمل التمرين دون وضع يده على الحائط من الممكن ان يقوم به من خلال وضع يده السليمة على الكتف المصاب والنظر الى المرأة</p>	
	<p><b>تكرار:</b> معدل دقيقتين</p> <p><b>الجولات:</b> مرتين يوميا</p> <p><b>معدل:</b> 3 مرات أسبوعيا</p>	<p>يفف المريض مع وضع ذراعه على طرف الحائط بزاوية 90 درجة مع إبقاء اليد في الوضع الطبيعي (راحة اليد نحو الجانب) ولوح الكتف في وضع محايد ثم يُطلب من المريض ارجاع يده للخلف بمقدار 15 درجة مع إبقاء الحفاظ على الوضع الطبيعي في لوح الكتف وإعادة الذراع الى الجانب</p> <p>عند التحسن يقوم المريض بعمل التمرين من وضع اليد الممدودة ويمكن وضع يده السليمة على الكتف المصاب للشعور بعد فقدان التحكم الحركي في الكتف</p>	<p><b>مد الكتف للخلف</b></p>

## Appendix 9: Ethical Committee Approval.



Al Quds University  
Faculty of Health Professions  
Jerusalem – Abu Dis



جامعة القدس  
كلية المهن الصحية  
القدس – أبو ديس

---

Research Ethics Subcommittee of Faculty of Health Professions  
Letter of approval

Feb. 27, 2023  
Ref. No.: RESC/2023-12

Dear Applicants, (Dr. Akram Amro, Ms. Ayat Amro)  
Program: MSc Physiotherapy Department

The Research Ethics subcommittee of the Faculty of Health Professions has recently reviewed your proposal entitled (**The Effect of Kinetic Control Program Versus Rotator Cuff Muscle Imbalance-Based Program in Physiotherapy Management of Rotator Cuff Dysfunction - Randomized Control Trial - (RCT)**) submitted by (Dr. Akram Amro). Your proposal is deemed to meet the requirements of research ethics at Al-Quds University, but further assessment is required by the Central Research Ethics Committee of Al-Quds University. We wish you all best for the conduct of the project.

Hussein ALMasri  
Research Ethics Subcommittee Chair  
Faculty of Health Professions

*Hussein ALMasri*

CC: File  
CC: Committee members

## Appendix 10: Research Information Sheet



جامعة القدس \ ابو ديس

كلية المهن الصحية

العلاج الطبيعي والتأهيل

معلومات عن بحث علمي:

تقوم الباحثة آيات امين عمرو بأجراء بحث علمي، ضمن برنامج الماجستير في العلاج الطبيعي - جامعة القدس. و يهدف هذا البحث الى دراسة تأثير برنامج تمرينات التحكم الحركي مقابل التمرينات التقليدية في علاج الام أوتار الكتف /دراسة تجريبية، علما ان البرنامج لا يشتمل على أي خطر او ضرر للمرضى و ان اشتراك الطوعي في هذا البحث يسهم في البحث العلمي

ان اشتراكك في هذا البحث يتضمن الحفاظ على سرية و خصوصية المعلومات الخاصة بك، و لن يتم استخدام الأسماء في التحليل، و ان اشتراكك هو بشكل طوعي تام و لن يتم الاضرار باي من مصالحك في حالة الانسحاب، إذا كان لديك أي تساؤلات او استفسارات ارجوا التواصل على الأرقام المعلنة ادناه و سوف يكون من حقك الحصول على نتائج هذا البحث، اضافة الى انه سيتم الاحتفاظ بالمعلومات في مكان مغلق لا يستطيع الوصول اليه سوى الباحث , وانه ليس هناك اي ضرر محتمل من اشتراكك في هذا البرنامج العلاجي .

طريقة التواصل مع الباحث:

إذا كانت لديك بعض الأسئلة عن الدراسة للاستفسار يمكنكم التواصل مع (آيات امين عمرو) عن طريق (رقم الهاتف

0598789654) أو عنوان البريد ( [a\\_amro87@yahoo.com](mailto:a_amro87@yahoo.com) ) .

آيات عمرو

مع الاحترام

## Appendix 11: Constant Form



جامعة القدس \ ابو ديس

كلية المهن الصحية

العلاج الطبيعي والتأهيل

نموذج موافقة على المشاركة في بحث علمي:

تأثير برنامج التمارين المبني على التحكم الحركي مقابل برنامج التمارين التقليدية في التحسن الوظيفي والحركي لمرضى ألم أوتار الكتف في فلسطين / تجربة سريرية عشوائية.

أنا الموقع أدناه ..... أوافق على المشاركة في البحث العلمي الذي ستقوم به أخصائية العلاج الطبيعي آيات عمرو، ضمن برنامج الماجستير في العلاج الطبيعي - جامعة القدس.

لقد قامت الباحثة بشرح مفصل عن أهداف الدراسة وحقوقها الأخلاقية عند المشاركة. والية البحث حيث أنني سأشارك في دراسة تهدف لدراسة تأثير برنامج التمارين المبني على التحكم الحركي مقابل برنامج التمارين التقليدية في التحسن الوظيفي والحركي لمرضى ألم أوتار الكتف في فلسطين / تجربة سريرية عشوائية.

علماً أنني أستطيع الانسحاب من الدراسة متى شئت واعلم أن المعلومات الخاصة بي لن تستعمل إلا لغرض البحث العلمي.

طريقة التواصل مع الباحث:

للاستفسار يمكنكم التواصل مع (آيات امين عمرو) عن طريق (رقم الهاتف 00972598789654) أو عنوان البريد (a\_amro87@yahoo.com) إذا كانت لديك بعض الأسئلة عن الدراسة.

التوقيع .....

التاريخ.....

## References

- AAOS. (2012). Rotator Cuff and Shoulder Conditioning Program STRETCHING EXERCISES 1. Pendulum. *American Academy of Orthopaedic Surgeons*, 11.  
[https://orthoinfo.aaos.org/en/recovery/rotator-cuff-and-shoulder-conditioning-program%0Awww.orthoinfo.org%0Ahttps://orthoinfo.aaos.org/globalassets/pdfs/2017-rehab\\_shoulder.pdf](https://orthoinfo.aaos.org/en/recovery/rotator-cuff-and-shoulder-conditioning-program%0Awww.orthoinfo.org%0Ahttps://orthoinfo.aaos.org/globalassets/pdfs/2017-rehab_shoulder.pdf)
- Applegate, K. A., Thiese, M. S., Merryweather, A. S., Kapellusch, J., Drury, D. L., Wood, E., Kendall, R., Foster, J., Garg, A., & Hegmann, K. T. (2017). Association between Cardiovascular Disease Risk Factors and Rotator Cuff Tendinopathy: A Cross-Sectional Study. *Journal of Occupational and Environmental Medicine*, 59(2), 154–160.  
<https://doi.org/10.1097/JOM.0000000000000929>
- Bae, Y. H., Lee, G. C., Shin, W. S., Kim, T. H., & Lee, S. M. (2011). Effect of motor control and strengthening exercises on pain, function, strength and the range of motion of patients with shoulder impingement syndrome. *Journal of Physical Therapy Science*, 23(4), 687–692. <https://doi.org/10.1589/jpts.23.687>
- Bakhsh, W., & Nicandri, G. (2018). Anatomy and Physical Examination of the Shoulder. *Sports Medicine and Arthroscopy Review*, 26(3), e10–e22.  
<https://doi.org/10.1097/JSA.0000000000000202>
- Burkhart, S. S., Morgan, C. D., & Kibler, W. Ben. (2003). The disabled throwing shoulder: Spectrum of pathology part III: The SICK scapula, scapular dyskinesis, the kinetic chain, and rehabilitation. *Arthroscopy - Journal of Arthroscopic and Related Surgery*, 19(6), 641–661.  
[https://doi.org/10.1016/S0749-8063\(03\)00389-X](https://doi.org/10.1016/S0749-8063(03)00389-X)
- Cardoso, T. B., Pizzari, T., Kinsella, R., Hope, D., & Cook, J. L. (2019). Current trends in tendinopathy management. *Best Practice and Research: Clinical Rheumatology*, 33(1), 122–140. <https://doi.org/10.1016/j.berh.2019.02.001>
- Challoumas, D., Biddle, M., McLean, M., & Millar, N. L. (2020). Comparison of Treatments for Frozen Shoulder: A Systematic Review and Meta-analysis. *JAMA Network Open*, 3(12).  
<https://doi.org/10.1001/jamanetworkopen.2020.29581>
- Chianca, V., Albano, D., Messina, C., Midiri, F., Mauri, G., Aliprandi, A., Catapano, M., Pescatori, L. C., Monaco, C. G., Gitto, S., Mainini, A. P., Corazza, A., Rapisarda, S., Pozzi, G., Barile, A., Masciocchi, C., & Sconfienza, L. M. (2018). Rotator cuff calcific tendinopathy: From diagnosis to treatment. *Acta Biomedica*, 89, 186–196.  
<https://doi.org/10.23750/abm.v89i1-S.7022>
- Comerford, M., & Mottram, S. (2012). *Kinetic control-e-book: The management of uncontrolled movement*.
- Cuthbert, S. C., & Goodheart, G. J. (2007). On the reliability and validity of manual muscle testing: A literature review. *Chiropractic and Osteopathy*, 15.

<https://doi.org/10.1186/1746-1340-15-4>

- Desmeules, F., Boudreault, J., Roy, J. S., Dionne, C. E., Frémont, P., & MacDermid, J. C. (2016). Efficacy of transcutaneous electrical nerve stimulation for rotator cuff tendinopathy: A systematic review. *Physiotherapy (United Kingdom)*, *102*(1), 41–49. <https://doi.org/10.1016/j.physio.2015.06.004>
- Dominguez-Romero, J. G., Jiménez-Rejano, J. J., Ridao-Fernández, C., & Chamorro-Moriana, G. (2021). Exercise-based muscle development programs and their effectiveness in the functional recovery of rotator cuff tendinopathy: A systematic review. *Diagnostics*, *11*(3). <https://doi.org/10.3390/diagnostics11030529>
- Dominguez-Romero, J. G., Jiménez-Rejano, J. J., Ridao-Fernández, C., Chamorro-Moriana, G., Uhl, T. L., Jaggi, A., Alexander, S., Requejo-Salinas, N., Lewis, J. S., Michener, L. A., La Touche, R., Fernández-Matías, R., Tercero-Lucas, J., Camargo, P. R., Bateman, M., Struyf, F., Roy, J. S., Jaggi, A., Uhl, T. L., ... Van Der Windt, D. A. (2018). Scapular focused interventions to improve shoulder pain and function in adults with subacromial pain: A systematic review and meta-analysis. *Archives of Physical Medicine and Rehabilitation*, *7*(3), 400–408. <https://doi.org/10.12965/jer.2040256.128>
- Ebenbichler, G. R., Erdogmus, C. B., Resch, K. L., Funovics, M. A., Kainberger, F., Barisani, G., Aringer, M., Nicolakis, P., Wiesinger, G. F., Baghestanian, M., Preisinger, E., Weinstabl, R., & Fialka-Moser, V. (1999). Ultrasound Therapy for Calcific Tendinitis of the Shoulder. *New England Journal of Medicine*, *340*(20), 1533–1538. <https://doi.org/10.1056/nejm199905203402002>
- El, O., Bircan, C., Gulbahar, S., Demiral, Y., Sahin, E., Baydar, M., Kizil, R., Griffin, S., & Akalin, E. (2006). The reliability and validity of the Turkish version of the Western Ontario rotator cuff index. *Rheumatology International*, *26*(12), 1101–1108. <https://doi.org/10.1007/s00296-006-0151-2>
- Giri, A., O’Hanlon, D., & Jain, N. B. (2022). Risk factors for rotator cuff disease: A systematic review and meta-analysis of diabetes, hypertension, and hyperlipidemia. *Annals of Physical and Rehabilitation Medicine*, *66*(1), 101631. <https://doi.org/10.1016/j.rehab.2022.101631>
- Gowd, A. K., Liu, J. N., Garcia, G. H., Cabarcas, B. C., & Verma, N. N. (2018). Arthroscopic Massive Rotator Cuff Repair and Techniques for Mobilization. *Arthroscopy Techniques*, *7*(6), e633–e638. <https://doi.org/10.1016/j.eats.2018.02.013>
- Grusky, A. Z., Giri, A., O’Hanlon, D., & Jain, N. B. (2022). The Relationship of Aging and Smoking With Rotator Cuff Disease: A Systematic Review and Meta-analysis. *American Journal of Physical Medicine & Rehabilitation*, *101*(4), 331–340. <https://doi.org/10.1097/PHM.0000000000001820>
- Gummesson, C., Ward, M. M., & Atroshi, I. (2006). The shortened disabilities of the arm, shoulder, and hand questionnaire (QuickDASH): Validity and reliability based on responses within the full-length DASH. *BMC Musculoskeletal Disorders*, *7*, 1–7. <https://doi.org/10.1186/1471-2474-7-44>
- Hik, F., & Ackland, D. C. (2019). The moment arms of the muscles spanning the glenohumeral

joint: a systematic review. *Journal of Anatomy*, 234(1), 1–15.  
<https://doi.org/10.1111/joa.12903>

Javed, O., Maldonado, K. A., & Ashmyan, R. (2022). *Anatomy, Shoulder and Upper Limb, Muscles*.

Joossens, L., & Struyf, F. (2015). *An update of systematic reviews examining the effectiveness of conservative physiotherapy interventions for subacromial shoulder pain*.

Kelly, S. M., Brittle, N., & Allen, G. M. (2010). The value of physical tests for subacromial impingement syndrome: A study of diagnostic accuracy. *Clinical Rehabilitation*, 24(2), 149–158. <https://doi.org/10.1177/0269215509346103>

Kubik-huch, R. A., & Schulthess, G. K. Von. (2021). *Musculoskeletal Diseases 2021 – 2024*. In Springer.

Kuhn, J. E. (2009a). *Exercise in the treatment of rotator cuff impingement : A systematic review and a synthesized evidence-based rehabilitation protocol*. 138–160.  
<https://doi.org/10.1016/j.jse.2008.06.004>

Kuhn, J. E. (2009b). Exercise in the treatment of rotator cuff impingement: A systematic review and a synthesized evidence-based rehabilitation protocol. *Journal of Shoulder and Elbow Surgery*, 18(1), 138–160. <https://doi.org/10.1016/j.jse.2008.06.004>

Kuijjer, P. P. F. M., Van Der Molen, H. F., & Frings-Dresen, M. H. W. (2012). Evidence-based exposure criteria for work-related musculoskeletal disorders as a tool to assess physical job demands. *Work*, 41(SUPPL.1), 3795–3797. <https://doi.org/10.3233/WOR-2012-0001-3795>

Leong, H. T., Fu, S. C., He, X., Oh, J. H., Yamamoto, N., & Yung, S. H. P. (2019). Risk factors for rotator cuff tendinopathy: A systematic review and meta-analysis. *Journal of Rehabilitation Medicine*, 51(9), 627–637. <https://doi.org/10.2340/16501977-2598>

Lewis, J., McCreesh, K., Roy, J. S., & Ginn, K. (2015). Rotator cuff tendinopathy: Navigating the diagnosis-management conundrum. *Journal of Orthopaedic and Sports Physical Therapy*, 45(11), 923–937. <https://doi.org/10.2519/jospt.2015.5941>

Lin, T. T. L., Lin, C. H., Chang, C. L., Chi, C. H., Chang, S. T., & Sheu, W. H. H. (2015). The Effect of Diabetes, Hyperlipidemia, and Statins on the Development of Rotator Cuff Disease: A Nationwide, 11-Year, Longitudinal, Population-based Follow-up Study. *American Journal of Sports Medicine*, 43(9), 2126–2132. <https://doi.org/10.1177/0363546515588173>

Littlewood, C., Malliaras, P., Bateman, M., Stace, R., May, S., & Walters, S. (2013). The central nervous system - An additional consideration in “rotator cuff tendinopathy” and a potential basis for understanding response to loaded therapeutic exercise. *Manual Therapy*, 18(6), 468–472. <https://doi.org/10.1016/j.math.2013.07.005>

Littlewood, C., May, S., & Walters, S. (2013). A Review of Systematic Reviews of the Effectiveness of Conservative Interventions for Rotator Cuff Tendinopathy. *Shoulder and Elbow*, 5(3), 151–167. <https://doi.org/10.1111/sae.12009>

Liu, J. N., Garcia, G. H., Gowd, A. K., Cabarcas, B. C., Charles, M. D., Romeo, A. A., & Verma, N. N. (2018). Treatment of Partial Thickness Rotator Cuff Tears in Overhead Athletes. *Current*

*Reviews in Musculoskeletal Medicine*, 11(1), 55–62. <https://doi.org/10.1007/s12178-018-9459-2>

- Luomajoki, H., Kool, J., De Bruin, E. D., & Airaksinen, O. (2008). Movement control tests of the lower back; Evaluation of the difference between patients with low back pain and healthy controls. *BMC Musculoskeletal Disorders*, 9(Mc), 1–12. <https://doi.org/10.1186/1471-2474-9-170>
- MacChi, M., Spezia, M., Elli, S., Schiaffini, G., & Chisari, E. (2020). Obesity increases the risk of tendinopathy, tendon tear and rupture, and postoperative complications: A systematic review of clinical studies. *Clinical Orthopaedics and Related Research*, 478(8), 1839–1847. <https://doi.org/10.1097/CORR.0000000000001261>
- Macdonald, P. B., Clark, P., & Sutherland, K. (2000). An analysis of the diagnostic accuracy of the Hawkins and Neer subacromial impingement signs. *Journal of Shoulder and Elbow Surgery*, 9(4), 299–301. <https://doi.org/10.1067/MSE.2000.106918>
- Mallows, A., Debenham, J., Walker, T., & Littlewood, C. (2017). Association of psychological variables and outcome in tendinopathy: A systematic review. *British Journal of Sports Medicine*, 51(9), 743–748. <https://doi.org/10.1136/bjsports-2016-096154>
- Mcclure, P. W., Michener, L. A., & Karduna, A. R. (2006). 1075.Full.Pdf. 86(8).
- McMullen, J., & Uhl, T. L. (2000). A Kinetic Chain Approach for Shoulder Rehabilitation. *Journal of Athletic Training*, 35(3), 329–337.
- Mertens, M. G., Meert, L., Struyf, F., Schwank, A., & Meeus, M. (2022). Exercise Therapy Is Effective for Improvement in Range of Motion, Function, and Pain in Patients With Frozen Shoulder: A Systematic Review and Meta-analysis. *Archives of Physical Medicine and Rehabilitation*, 103(5), 998-1012.e14. <https://doi.org/10.1016/J.APMR.2021.07.806>
- Mintken, P. E., Glynn, P., & Cleland, J. A. (2009). Psychometric properties of the shortened disabilities of the Arm, Shoulder, and Hand Questionnaire (QuickDASH) and Numeric Pain Rating Scale in patients with shoulder pain. *Journal of Shoulder and Elbow Surgery*, 18(6), 920–926. <https://doi.org/10.1016/j.jse.2008.12.015>
- Mitchell, K., Gutierrez, S. B., Sutton, S., Morton, S., & Morgenthaler, A. (2014). Reliability and validity of goniometric iPhone applications for the assessment of active shoulder external rotation. *Physiotherapy Theory and Practice*, 30(7), 521–525. <https://doi.org/10.3109/09593985.2014.900593>
- Mottram; S.L. (1997). Dynamic Stability of the Scapula.pdf. In *Manual Therapy* (Vol. 2, Issue 3, pp. 123–131).
- Muth, S., Barbe, M. F., Lauer, R., & McClure, P. (2012). The effects of thoracic spine manipulation in subjects with signs of rotator cuff tendinopathy. *Journal of Orthopaedic and Sports Physical Therapy*, 42(12), 1005–1016. <https://doi.org/10.2519/jospt.2012.4142>
- Page, M. J., Green, S., Kramer, S., Johnston, R. V., Mcbain, B., Chau, M., & Buchbinder, R. (2014). Manual therapy and exercise for adhesive capsulitis (frozen shoulder). *Cochrane Database of Systematic Reviews*, 2014(8). <https://doi.org/10.1002/14651858.CD011275>

- Page, M. J., Green, S., Mrocki, M. A., Surace, S. J., Deitch, J., Mcbain, B., Lyttle, N., & Buchbinder, R. (2016). Electrotherapy modalities for rotator cuff disease. *Cochrane Database of Systematic Reviews*, 2016(6). <https://doi.org/10.1002/14651858.CD012225>
- Park, H. Bin, Yokota, A., Gill, H. S., El Rassi, G., & McFarland, E. G. (2005). Diagnostic accuracy of clinical tests for the different degrees of subacromial impingement syndrome. *Journal of Bone and Joint Surgery*, 87(7), 1446–1455. <https://doi.org/10.2106/JBJS.D.02335>
- Pedersen, B. K., & Saltin, B. (2015). Exercise as medicine - Evidence for prescribing exercise as therapy in 26 different chronic diseases. *Scandinavian Journal of Medicine and Science in Sports*, 25, 1–72. <https://doi.org/10.1111/sms.12581>
- Razmjou, H., Lincoln, S., Macritchie, I., Richards, R. R., Medeiros, D., & Elmaraghy, A. (2016). Sex and gender disparity in pathology, disability, referral pattern, and wait time for surgery in workers with shoulder injury. *BMC Musculoskeletal Disorders*, 17(1), 1–9. <https://doi.org/10.1186/s12891-016-1257-7>
- Richardson, E., Lewis, J. S., Gibson, J., Morgan, C., Halaki, M., Ginn, K., & Yeowell, G. (2020). Role of the kinetic chain in shoulder rehabilitation: Does incorporating the trunk and lower limb into shoulder exercise regimes influence shoulder muscle recruitment patterns? A systematic review of electromyography studies. *BMJ Open Sport and Exercise Medicine*, 6(1), 1–12. <https://doi.org/10.1136/bmjsem-2019-000683>
- Riemann, B. L., & Lephart, S. M. (2002). The Sensorimotor System, Part II : The Role. *Journal of Athletic Training*, 37(1), 80–84.
- Rodriguez Diez-Caballero, B., Alfonso-Beltrán, J., Bautista, I. J., & Barrios, C. (2020). Occupational risk factors for shoulder chronic tendinous pathology in the Spanish automotive manufacturing sector: a case-control study. *BMC Musculoskeletal Disorders*, 21(1), 1–8. <https://doi.org/10.1186/s12891-020-03801-5>
- Roy, J., & Frémont, P. (2015). The Efficacy of Manual Therapy for Rotator Cuff Tendinopathy: *Journal of Orthopaedic & Sports Physical Therapy*, 1–44.
- Rudzki, J. R., Adler, R. S., Warren, R. F., Kadrmas, W. R., Verma, N., Pearle, A. D., Lyman, S., & Fealy, S. (2008). Contrast-enhanced ultrasound characterization of the vascularity of the rotator cuff tendon: Age- and activity-related changes in the intact asymptomatic rotator cuff. *Journal of Shoulder and Elbow Surgery*, 17(1 SUPPL.), 96–100. <https://doi.org/10.1016/j.jse.2007.07.004>
- Ryösä, A., Laimi, K., Äärimala, V., Lehtimäki, K., Kukkonen, J., Saltychev, M., Leong, H. T., Fu, S. C., He, X., Oh, J. H., Yamamoto, N., Yung, S. H. P., Littlewood, C., Malliaras, P., Chance-Larsen, K., Bakhsh, W., Nicandri, G., Doiron-Cadrin, P., Lafrance, S., ... Lewis, J. S. (2018). Scapular focused interventions to improve shoulder pain and function in adults with subacromial pain: A systematic review and meta-analysis. *Clinical Orthopaedics and Related Research*, 39(3), 400–408. <https://doi.org/10.12965/jer.2040256.128>
- Ryösä, A., Laimi, K., Äärimala, V., Lehtimäki, K., Kukkonen, J., Saltychev, M., Leong, H. T., Fu, S. C., He, X., Oh, J. H., Yamamoto, N., Yung, S. H. P., Littlewood, C., Malliaras, P., Chance-Larsen, K., Bakhsh, W., Nicandri, G., Doiron-Cadrin, P., Lafrance, S., ... Uhl, T. L. (2018). Scapular

focused interventions to improve shoulder pain and function in adults with subacromial pain: A systematic review and meta-analysis. *Journal of Athletic Training*, 35(3), 1–8.  
<https://doi.org/10.12965/jer.2040256.128>

Saito, H., Harrold, M. E., Cavalheri, V., & McKenna, L. (2018). Scapular focused interventions to improve shoulder pain and function in adults with subacromial pain: A systematic review and meta-analysis. *Physiotherapy Theory and Practice*, 34(9), 653–670.  
<https://doi.org/10.1080/09593985.2018.1423656>

Sayampanathan, A. A., & Andrew, T. H. C. (2017). A systematic review on risk factors of rotator cuff tears. *Journal of Orthopaedic Surgery (Hong Kong)*, 25(1), 1–9.  
<https://doi.org/10.1177/2309499016684318>

Sedgwick, P. (2013). Convenience sampling. *Bmj*, 347(oct25 2), f6304–f6304.  
<https://doi.org/10.1136/bmj.f6304>

Shire, A. R., Stæhr, T. A. B., Overby, J. B., Bastholm Dahl, M., Sandell Jacobsen, J., & Høyrup Christiansen, D. (2017). Specific or general exercise strategy for subacromial impingement syndrome- does it matter? A systematic literature review and meta-analysis. *BMC Musculoskeletal Disorders*, 18(1). <https://doi.org/10.1186/s12891-017-1518-0>

Struyf, F., Cagnie, B., Cools, A., Baert, I., Brempt, J. Van, Struyf, P., & Meeus, M. (2014). Scapulothoracic muscle activity and recruitment timing in patients with shoulder impingement symptoms and glenohumeral instability. *Journal of Electromyography and Kinesiology*, 24(2), 277–284. <https://doi.org/10.1016/j.jelekin.2013.12.002>

Struyf, F., Nijs, J., Mottram, S., Roussel, N. A., Cools, A. M. J., & Meeusen, R. (2014). Clinical assessment of the scapula: A review of the literature. *British Journal of Sports Medicine*, 48(11), 883–890. <https://doi.org/10.1136/bjsports-2012-091059>

Sutinen, P., Toppila, E., Starck, J., Brammer, A., Zou, J., & Pyykkö, I. (2006). Hand-arm vibration syndrome with use of anti-vibration chain saws: 19-year follow-up study of forestry workers. *International Archives of Occupational and Environmental Health*, 79(8), 665–671.  
<https://doi.org/10.1007/s00420-006-0099-2>

Trivedi, S., Pomerantz, M. L., Gross, D., Golijanan, P., & Provencher, M. T. (2014). Shoulder instability in the setting of bipolar (glenoid and humeral head) bone loss: The glenoid track concept. *Clinical Orthopaedics and Related Research*, 472(8), 2352–2362.  
<https://doi.org/10.1007/s11999-014-3589-7>

Tytherleigh-strong, G., Orth, F., Hirahara, A., & Miniaci, A. (2001). *Tytherleigh-Strong2001*. 135–145.

Vila-Dieguez, O., Heindel, M. D., Awokuse, D., Kulig, K., & Michener, L. A. (2023). Exercise for rotator cuff tendinopathy: Proposed mechanisms of recovery. *Shoulder and Elbow*, 15(3), 233–249. <https://doi.org/10.1177/17585732231172166>

Wattanaprakornkul, D., Halaki, M., Boettcher, C., Cathers, I., & Ginn, K. A. (2011). A comprehensive analysis of muscle recruitment patterns during shoulder flexion: An electromyographic study. *Clinical Anatomy*, 24(5), 619–626.  
<https://doi.org/10.1002/ca.21123>

- Williamson, A., & Hoggart, B. (2005). Pain: A review of three commonly used pain rating scales. *Journal of Clinical Nursing, 14*(7), 798–804. <https://doi.org/10.1111/j.1365-2702.2005.01121.x>
- Worsley, P., Warner, M., Mottram, S., Gadola, S., Veeger, H. E. J., Hermens, H., Morrissey, D., Little, P., Cooper, C., Carr, A., & Stokes, M. (2013). Motor control retraining exercises for shoulder impingement: Effects on function, muscle activation, and biomechanics in young adults. *Journal of Shoulder and Elbow Surgery, 22*(4), e11–e19. <https://doi.org/10.1016/j.jse.2012.06.010>
- Yamauchi, T., Hasegawa, S., Matsumura, A., Nakamura, M., Ibuki, S., & Ichihashi, N. (2015). The effect of trunk rotation during shoulder exercises on the activity of the scapular muscle and scapular kinematics. *Journal of Shoulder and Elbow Surgery, 24*(6), 955–964. <https://doi.org/10.1016/j.jse.2014.10.010>
- Yi, D., Lim, H., & Yim, J. (2021). Effect of microcurrent stimulation on pain, shoulder function, and grip strength in early postoperative phase after rotator cuff repair. *Medicina (Lithuania), 57*(5). <https://doi.org/10.3390/medicina57050491>