

Efficacy assessment of shoulder rehabilitation with Contrex MJ robot in patients with periarthritis humeroscapularis

Bui Thi Hong Thuy, Nguyen Trong Luu,
Pham Thi Le Hang, Nguyen Manh Hung

108 Military Central Hospital

Summary

Objective: To assess the efficacy of shoulder rehabilitation program incorporating exercise with Contrex MJ robot in patients with periarthritis humeroscapularis. **Subject and method:** We evaluated a total of 62 patients ($n = 62$) suffered from the non-specific shoulder pain and frozen shoulder, who were admitted to our medical institution between June of 2016 and May of 2017. In these patients, the efficacy outcome measures were improved in Visual Analogue Scale, Range of motion. **Result and conclusion:** There were improvements of periarthritis humeroscapularis from five to fifteen day treatment period ($p=0.04$), there were not any cases with complications in our subjects.

Keywords: Periarthritis humeroscapularis, non-specific shoulder pain, frozen shoulder, rehabilitation, Contrex MJ robot.

1. Background

Periarthritis humeroscapularis is a term used to present all cases of shoulder pain and causes substantial morbidity due to damage the tissue of the shoulder, mainly tendons, muscles, ligaments [2], [5], [8], [9].

Periarthritis humeroscapularis is very common. According to population surveys, shoulder pain affects 18 - 26% of adults at any point in time making it one of the most common regional pain syndromes. Symptoms can be persistent and disabling in terms of an individual's ability to carry out daily activities both at home and in the workplace. There are also substantial economic costs involved, with increased demands on health care, impaired

work performance, substantial sickness absence, and early retirement or job loss.

Treatment of periarthritis humeroscapularis can use one or more of the combination methods such as: Medicine, surgery, physiotherapy. The goal of treatments is to reduce pain, increase range of motion, decrease recovery time and improve quality of life for patients. The exercises include passive activities, active assisted activities, active activities, resistance activities.

Contrex MJ robot is one of the modern medical training systems in hospitals in Vietnam, is a versatile, rotatory testing, training and therapeutic system to test and train all major joints of the upper and lower limbs in the open kinetic chain. The highly flexible mechanism with excellent operator guidance makes objective and reproducible test results possible in every work mode. Treatment programs are designed on the Contrex MJ robot which are very suitable with condition patients because the robot accuracy and very close adjustment of the rotary axis of the dynamometer in relation to the joint axis.

Correspondence to: Nguyen Trong Luu - Rehabilitation Department, 108 Military Central Hospital.

Email: trongluu108@gmail.com.

In addition, the Contrex MJ robot also has a very high safety training system because the continuous adjustable mechanical movement stops limit the range of movement directly at the dynamometer. The position of the movement stops is tracked by the system and constantly matched against the selected movement pattern. Thus, the software redundantly prevents exceedance of the movement amplitude. To optimize the effectiveness of the Contrex MJ robot application in the treatment of patients with periarthritis humeroscapularis, we conducted this study *to assess the efficacy of shoulder rehabilitation program incorporating exercise with Contrex MJ robot in patients with periarthritis humeroscapularis*.

2. Subject and method

2.1. Subject

We evaluated a total of 62 patients with periarthritis humeroscapularis who were admitted to Rehabilitation Department, 108 Military Central Hospital between June of 2016 and May of 2017. The inclusion criteria: over 16 years old, have shoulder disorders, according to the guidelines of the Vietnam Rheumatology Association 2016 [5], agreed to participate in our study. The exclusion criteria were patients who had to be injected corticosteroids within 4 weeks, patients with shoulder pain after injury, shoulder infection, patients do not allow the full treatment process.

2.2. Method

The research design is a prospective, descriptive cross-sectional study on intervention efficacy, convenient sampling.

The variables and indicators of study include:

Evaluation of pain level by Visual Analogue Scale (VAS), Normal: 0 point; Mild: 1 - 3 points; Medium: 4 - 7 points; Serious: 8 - 10 points.

Evaluation of stiffness level by the Mc Gill-Romi.

Motion	ROM	Level
Abduction	> 150°	0
	101 - 150°	1
	51 - 100°	2

External rotation	0 - 50°	3
	> 85°	0
	61 - 85°	1
	31 - 60°	2
Internal rotation	0 - 30°	3
	> 85°	0
	61 - 85°	1
	31 - 60°	2
	0 - 30°	3

General results: Good: 0 - 5 points, Pretty good: 6 - 10 points, Medium: 11 - 15 points, Bad: 16 - 19 points.

Recording the time of side effects: fractures, sprains, joint defects, ligament ruptures, pain lasting more than 3 hours after doing exercise.

Intervention time: Revaluation after at day 5, 10, 15.

Treatment for periarthritis humeroscapularis [8], [9]

Massage.

Activity exercises: Include passive activities, active assisted activities, active activities, resistance activities by therapists.

Physiotherapy: Paraffin, Electro-pulsed, ion electrophoresis, ultrasound.

Medications: NSAID, Eperisone.

Surgery.

Treatment for periarthritis humeroscapularis on Contrex MJ robot [10]

Design exercises for the patients on software.

Select the appropriate exercise for each patient based on the assessment on pain level, stiffness level: passive activities, active assisted activities, active activities, resistance activities, concentric/ concentric (Con/Con), concentric/ eccentric (Con/Ecc), eccentric/ concentric (Ecc/Con), eccentric/ eccentric (Ecc/Ecc), repeat, force, break time.

Install modules to robot and self test.

Position the patient on his back or tilt, depending on range of motion: Flexion-extension, adduction- abduction, internal rotation-external rotation.

Fix the patient's shoulder with exercise module.

Introduce to the patient how to coordinate do exercises with the robot.

Training according to the program installed.

Observing the patient exercises outcomes.

In the end, saving the patient's results as a basis for the next.

2.3. Data analysis

Use software SPSS 20.0.

Statistics calculated percentage.

Test χ^2 for comparing 2 rate variables.

$p < 0.05$ is considered as a statistically significant difference.

3. Result

3.1. General characteristics

3.1.1. Age

Table 1. Characteristics of age

Age group	Non-specific shoulder pain		Frozen shoulder		Sum	
	n	%	n	%	n	%
≤ 40	1	2.9	0	0.0	1	1.6
41 - 50	2	5.9	3	10.7	5	8.1
51 - 60	11	32.4	9	32.1	20	32.2
61 - 70	15	44.1	13	46.4	28	45.2
> 70	5	14.7	3	10.7	8	12.9
p	0.831				62	100

Comment: The highest rate was the age group 51 - 70 years old: 77.4%. The rate of age group ≤ 40 years old was the lowest: 1.6%, but the difference was not statistically significant with $p > 0.05$.

3.1.2. Gender

Table 2. Characteristics of gender

Gender	Non-specific shoulder pain		Frozen shoulder		Sum	
	n	%	n	%	n	%
Male	13	38.2	14	50	27	43.5
Female	21	61.8	14	50	35	56.5
p	0.352				62	100

Comment: The rate of female patients (56.5%) was higher than male patients (43.5%), but the difference was not statistically significant with $p > 0.05$.

3.1.3. Shoulder position

Table 3. Shoulder position

Position	Non-specific shoulder pain		Frozen shoulder		Sum	
	n	%	n	%	n	%
Right	22	64.7	18	64.3	40	64.5
Left	12	35.3	10	35.7	22	35.5
p	0.973				62	100

Comment: The rate of right shoulder/ left shoulder = 1.8 times, however the difference was not statistically significant with $p > 0.05$.

3.1.4. The intervention time

Table 4. The intervention time

Time	Non-specific shoulder pain		Frozen shoulder		Sum	
	n	%	n	%	n	%
< 1 month	9	26.5	6	21.4	15	24.2
1 - 3 months	9	26.5	9	32.1	18	29.0
> 3 months	16	47.1	13	46.4	29	46.8
p	0.847				62	100

Comment: The majority of patients who were treated over 3 months (46.8%). There was no difference between two types with $p>0.05$.

3.2. Results

3.2.1. The improvement in pain level after treatment

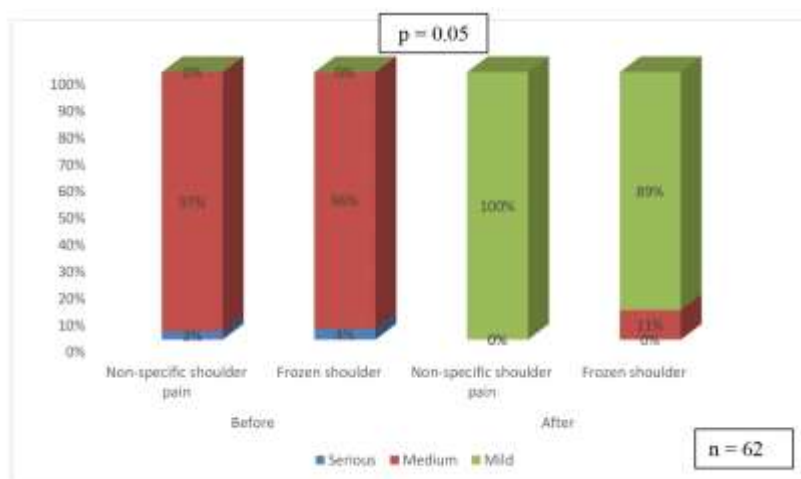


Figure 1. The improvement in pain level after treatment

Comment: After treatment, the type non-specific shoulder pain had no patients at medium and serious pain level, the type frozen shoulder had 11% patients at medium pain level. The reduction of pain level in both types after 15 days of treatment had difference which was statistically significant with $p<0.05$.

3.2.2. The improvement in range of motion after treatment

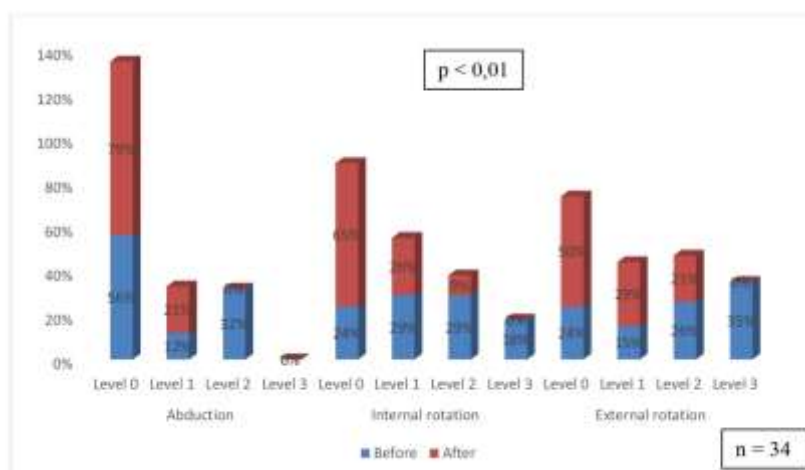


Figure 2. The improvement in stiffness level after treatment of type non-specific shoulder pain

Comment: After treatment, there was no patient at serious stiffness level in abduction, internal rotation, external rotation. In abduction, there were patients at mild stiffness level (21%) and normal (79%), In internal and external rotation, the rate of mild stiffness level was 91% and normal was 79%. The reduction of stiffness level after treatment had difference which was statistically significant with $p < 0.05$.

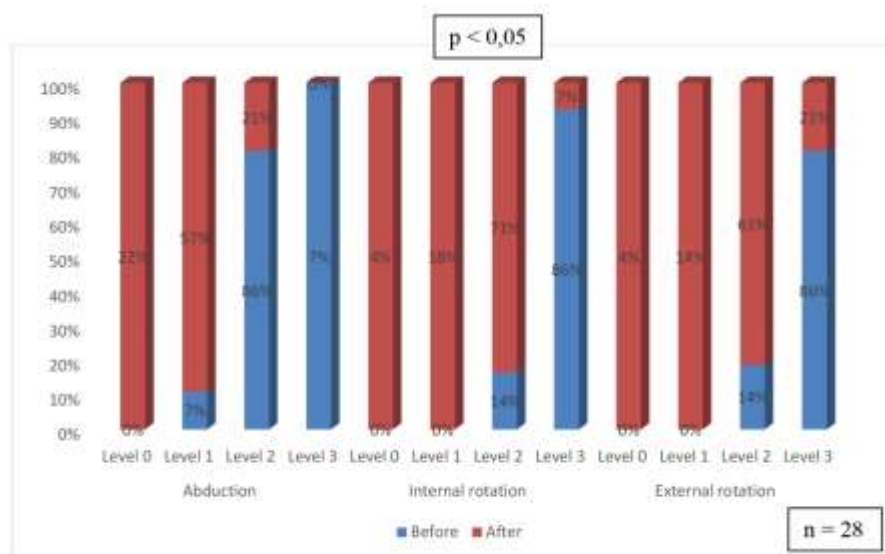


Figure 3. The improvement in stiffness level after treatment of frozen shoulder

Comment: After treatment, the rate of patients at normal abduction increased from 0 - 22%, there was no patient at serious stiffness level. The rate of patients at normal internal rotation increased from 0% to 4%; Most of patients were at medium stiffness level: 71% (internal rotation) and 61% (external rotation). The reduction of stiffness level after treatment had difference which was statistically significant with $p < 0.05$.

3.2.3. General results

Table 5. General results of both types

Result	Non-specific shoulder pain	Frozen shoulder	p
--------	----------------------------	-----------------	---

	n	%	n	%	
Good	14	41.2	10	35.7	0.04
Pretty good	20	58.8	12	42.9	
Medium	0	0	5	17.9	
Bad	0	0	1	3.6	
Sum	34	100	28	100	

Comment: Rate of good and pretty good results were very high: 100% (Non-specific shoulder pain) and 78.6% (Frozen shoulder). In type frozen shoulder, there were patients at medium and bad results: 21.5%. The difference which was statistically significant with $p < 0.05$.

4. Discussion

Research results showed that the rate of patients with periarthritis humeroscapularis was most common in age groups 51 - 70 years old (77.4%), this was also consistent with the research of Nguyen Thi Nga (2006) [6]: Majority in age groups 50 - 69 years old, Nguyen Huu Huyen (2008) [3]: majority in age groups 51 - 60 years old, Doan Quang Huy (1999) [4]: Majority in age groups over 50, Le Thi Hoai Anh (2001) [1]: Average age was 53.9, Tran Hong Nghi (2015) [7]: Average age was 59.6.

It can be said that, in this age, the successive micro-injuries due to overuse of the shoulder are a favorable factor in causing periarthritis humeroscapularis. Thus, periarthritis humeroscapularis are also the gradual degeneration of soft tissue around the shoulder joint. Therefore, under 50 years old, although degenerative have appeared, but the level degenerative is not serious and the recovery is still good. Over the age of 50s, the degree of degeneration is more serious, thus increasing the level of periarthritis humeroscapularis. However, after the age of 70s, the patients are resting, do not have to do many things that have a strong impact on the shoulder joint, the rate of inflammation around the shoulder joint decreases.

The study showed that the rate of female patients is higher than male patients with the ratio of female/ male = 35/27, this was similar to Nguyen Huu Huyen (2008): 51/48, Nguyen Thi Nga (2006): 56/44, Le Thi Hoai Anh: 57/43. This showed that, women, especially Vietnamese women, often have to do much housework which used the shoulder joint constantly, repeating every day, so making the ligaments and other structures in the shoulder joints are damaged. In addition, the aging process in women occurs more quickly than in men due to postmenopausal, female hormonal is also an advantageous factor.

In the study, we met the majority of patients with right periarthritis humeroscapularis at the rate of 64.5%, this result is similar to some authors Nguyen Thi Nga (58%), Nguyen Huu Huyen (52%), Le Thi Hoai Anh (56%), Tran Hong Nghi (73%). According to the pathogenetic mechanism, the dominant arm is often subject to the pressure of prolonged micro-trauma. The right hand is the dominant hand of the majority of patients, so the right shoulder movement is more frequent and excessive than the other side, which is also a factor that increases the rate of inflammation around the shoulder joint.

The duration of the disease, we obtained the highest rate of patients with chronic periarthritis humeroscapularis over 3 months: 46.8%, this result is similar to some authors Nguyen Thi Nga (45%), Nguyen Huu Huyen (45%), Tran Hong Nghi (40%). This showed that the periarthritis humeroscapularis are a disease with a long duration, poor recovery. It requires appropriate treatment and a combination of many treatments.

The duration of the illness may be related to the outcome of treatment, the short duration of illness the higher good results. However, in Vietnam, patients often have the habit of buying drugs for treatment themselves in early stage of disease, after a period of time the disease does not improve, the range of motion is limited, they decide to visit doctor. That explained the results of our research and other authors in most studies have a high rate of patients with duration of disease over 3 months.

After the treatment, the pain level was reduced, there was no patient with serious pain; rate of mild pain level in non-specific shoulder pain in non-specific shoulder pain increased to 100%, frozen shoulder increased more slowly (89%); This showed that training with the Contrex MJ robot had a good effect to reduce the pain level, it solved one of the important symptoms affecting the patient's quality of life, to help patients to pursue, maintain the treatment process.

Through the research, we found that exercising with Contrex MJ robot, the range of motions was improved on both types non-specific shoulder pain and frozen shoulder.

In type non-specific shoulder pain, after treatment, there was no patient who had abduction at serious stiffness level, the rate of patients at medium stiffness level reduced from 32% to 0%, the rate of patients at normal increased from 56% to 79%; the patients had internal rotation at medium and serious stiffness level reduced from 47% to 9%, at normal level increased from 24% to 65%; the patients have external rotation medium and serious stiffness level reduced from 62% to 21%, at normal level increased from 24% to 50%. That explained that the patients with non-specific shoulder pain, the limited range of joint mobility is mainly limited to active range because the patients are afraid of pain and do not perform exercise. However, the passive range is still possible with the help of therapists. After a period of combined training on

the Contrex MJ robot, the patient's pain level was reduced, the patients performed the movement more easily, the range of motion improved significantly.

In type frozen shoulder, after treatment, the patients had abduction at medium and serious stiffness level reduced from 93% to 21%, at mild stiffness level and normal increase from 7% to 79%; the patients had internal rotation at medium and serious stiffness level reduced from 100% to 78%, at mild stiffness level and normal increase from 0% to 22%; the patients had internal rotation at medium and serious stiffness level reduced from 62% to 21%, at mild stiffness level and normal increase from 0% lên 18%. It can be seen that the combined exercise on the Contrex MJ robot, the range of motion improved, but the stiffness level reduced slowly, the treatment need to pursue in a long time.

Training on the Contrex MJ robot, the good and pretty good results were 100% patients in the non-specific shoulder pain and 78.6% in the frozen shoulder. These results showed that the application of this equipment to treat for patients with periarthritis humeroscapularis had good effect in both types, but it was better when treating for patients with non-specific shoulder pain. The difference which was statistically significant with $p < 0.05$.

5. Conclusion

Efficacy assessment of treatment for 62 patients with periarthritis humeroscapularis who were admitted to Rehabilitation Department, 108 Military Central Hospital between June of 2016 and May of 2017, combined doing exercises on the Contrex MJ robot, we have some results:

The rate of patients with mild pain level after treatment of type non-specific shoulder pain was 100%, frozen shoulder was 89%; The level of pain relief was statistically significant with $p < 0.05$.

After treatment, the rate of patients in non-specific shoulder pain at serious stiffness level was 0%.

After treatment, the rate of patients in frozen shoulder at normal abduction increased: To 21%, Majority of patients at mild stiffness rotation: 71% (internal rotation) and 61% (external rotation).

Side effects: There were no side effects when exercising with Contrex MJ robot.

References

1. Lê Thị Hoài Anh (2001) *Đánh giá hiệu quả điều trị viêm quanh khớp vai bằng điện châm, xoa bóp kết hợp vận động trị liệu*. Luận văn Thạc sĩ Y học, Đại học Y Hà Nội.
2. Trần Ngọc Ân (2002) *Viêm quanh khớp vai*. Bệnh thấp khớp, Nhà xuất bản Y học, tr. 364-374.
3. Nguyễn Hữu Huyền (2008) *Đánh giá hiệu quả điều trị vận động đối với bệnh nhân viêm quanh khớp vai thể frozen shoulder tắc nghẽn*. Luận văn bác sĩ chuyên khoa II Học viện Quân y.
4. Đoàn Quang Huy (1999) *Nghiên cứu tác dụng điều trị viêm quanh khớp vai của cây bạch hoa xà*. Luận văn Thạc sĩ Y học, Đại học Y Hà Nội.
5. Lê Thị Liễu (2016) *Viêm quanh khớp vai*. Phác đồ chẩn đoán và điều trị các bệnh cơ xương khớp thường gặp, Hội Thấp khớp học Việt Nam, Nhà xuất bản Giáo dục Việt Nam, tr. 225-231.
6. Nguyễn Thị Nga (2006) *Đánh giá hiệu quả điều trị viêm quanh khớp vai thể non-specific shoulder pain bằng thuốc kết hợp vật lý trị liệu phục hồi chức năng*. Luận văn bác sĩ chuyên khoa cấp II Đại học Y Hà Nội.
7. Trần Hồng Nghị, Nguyễn Minh Sơn, Nguyễn Việt Khoa, Hoàng Công Trọng (2015) *Nghiên cứu ứng dụng phương pháp tiêm Corticosteroid dưới hướng dẫn của siêu âm trong điều trị viêm quanh khớp vai thể viêm gân nhị đầu*. Đề tài khoa học công nghệ cấp Bệnh viện, Viện Nghiên cứu Khoa học Y Dược lâm sàng 108.
8. De Winter AF, Jans MP, Scholten RJ, Deville W, van Schaardenburg D, Bouter LM (1999) *Diagnostic classification of shoulder disorders: Interobserver agreement and determinants of disagreement*. Ann Rheum Dis 58: 272-277.
9. Ebenbichler GR, Erdogmus CB, Resch KL et al (1999) *Ultrasound therapy for calcific tendinitis of the shoulder*. N Eng J Med 340(20): 1533.
10. Operating instructions Con-trex MJ Multijoint module, Physiomed Technology for therapy.