J Int Acad Phys Ther Res 2015; 6(1): 824-827
ISSN 2092-8475
www.iaptr.org
http://dx.doi.org/10.5854/JIAPTR.2015.03.31.824

Effects of Joint Position on the Distraction Distance in Patients with Adhesive Capsulitis of Glenohumeral Joint

The purpose of this study was to investigate the effects of joint position on the distraction distance in patients with adhesive capsulitis of glenohumeral joint. The study was conducted upon 20 adults in their 40's with the findings of adhesive capsulitis of glenohumeral joint. These subjects were subdivided into 3 groups, which were a group with neutral position(n=7), second group with resting position(n=7) and third group with end-range position(n=6). After having the subject wearing sleeveless shirts exposing armpit and lying straight on the plinth, a physical therapist with OMT qualification pulled glenohumeral joint at the Grade III of Kaltenborn-Evjenth traction; and the distance between glenoid fossa and humeral head was measured with ultrasound. Following the application of traction, the group with resting position(.67±0.29) exhibited the longest distance between humeral head and glenoid fossa, and it was followed by neutral position(.50±0.25) and end-range position(.35±.21) in this order. From the comparison of these groups, there was no significant difference in distraction distance between resting position and neutral position; and there was again no significant difference in distraction distance between end-range position and neutral position. However, there was a significant difference in distraction distance between end-range position and resting position(p<.05). Upon application of the Grade III of Kaltenborn-Evjenth traction, it was evident that the distance between humeral head and glenoid fossa can be varied depending on the location of the joint.

Key words: *Joint position; ashesive capsulitis of glenohumeral joint; Kaltenborn-Evjenth traction*

Sam Sik Park[a], Ki Do Kim[a], Yong Pil Hwang[a], Ok Kon Moon[b], Bo Kyung Kim[a*], Wan Suk Choi[a],**

[a]International University of Korea, Jinju; [b]Howon University, Gunsan, Korea

Received : 18 December 2014
Revised : 17 January 2015
Accepted : 27 February 2015

Address for correspondence
* Correspondence author
Bo Kyung Kim, PT, PhD,
Tel : 82-55-751-8294
E-mail : heyuu98@empal.com
** Correspondence author
Wan Suk Choi, PT, PhD,
Department of Physical Therapy, International University of Korea, Sangmun-ri, Munsan-eup, Jinju, Korea
Tel : 82-55-751-8293
E-mail : y3korea@empal.com

INTRODUCTION

Frozen shoulder syndrome was first introduced in 1872 by Duplay who initially used the terminology of 'peri-arthritis scapulohumerale' and believed that it should be treated with manipulation under anesthetics. In 1934, Codman employed a terminology called 'frozen shoulder' in order to explain this condition; and many researchers have been performing a variety of physical therapies to treat frozen shoulder afterward(1).

Although it takes several months, closely supervised physical therapy is capable of delivering improvements on ROM and pains for up to 90% of the patients with chronic adhesive capsulitis of glenohumeral joint(2); and there have been reports that the application of non-operative program mostly brings satisfactory results to most patients (3). Regarding exercise treatments on the other hand, patients usually take active assisted ROM and gentle passive stretching exercise treatments where the exercise should be gently applied; and most of all, it has been known that forceful stretch is prohibited during the early phase of frozen shoulder(4).

Rizk TE et al.(5) applied TENS for the pain management while applying progressive abduction traction to patients with adhesive capsulitis of glenohumeral joint, and it delivered more cases of increased ROM than the heat treatment group accompanied by exercise and manipulation. On the other hand, Jürgel J et al.(6) conducted exercise treatment accompanied by massage, heat and electric treatment upon 10 patients with frozen

shoulder for 4 weeks; and following this treatment, therapeutic exercise group produce increased ROM significantly more than the heat treatment group. It was believed to be because the ligament creeps when prolonged tension is applied although strong ligament shows high resistance when sudden pulling is applied. Meanwhile, Nicholson(7) claimed that passive stretching in abduction delivers therapeutic advantage in addition to ROM improvement, and Watson-Jones(8) reported that 95% of the subjects exhibited satisfactory results in 6 months after applying stretching exercise program to 226 patients with adhesive capsulitis of glenohumeral joint.

As evidenced through preceding studies above, it is apparent that traction is an effective method for patients with adhesive capsulitis of glenohumeral joint; subsequently, this study conducted traction on the subjects at neutral position, resting position and end-range position in order to find out which location brings the most effective result during adhesive capsulitis of glenohumeral joint .

METHODS

Subjects

In this study, 20 subjects were selected from in patients with adhesive capsulitis of glenohumeral joint at Changwon Workers' Compensation Hospital in Gyeongsangnam-do. Mean age of the subjects was 45±7.96 years old, and their average height was 167.8±3.72cm. After providing sufficient verbal explanation on objective and methods of this study, oral or written consent was obtained from the subjects before the implementation of the study. At the same time, subjects were alerted for potential risks which may arise during the course of research, and they were fully notified of their right to quit the program at any time. This study was conducted under the sanction and approval by IRB, International University of Korea.

Methods

Throughout this study, ideal height was maintained during the examination by using treatment tables for OMT. Room temperature was strictly maintained at constant temperature in order to avoid stress of joint of skin of the subjects, and all subjects wore clothes exposing their shoulders. During the experiment, a physical therapist with Kaltenborn-Evjenth OMT qualification participated as a long examiner. After defining Grade Ⅲ to be between the first stop and the last stop within the anatomical scope of joint(9), glenohumeral joint was pulled from the end-range position, resting position and neutral position. The end-range position represents the maximum state of abduction under neutral rotation(10), and the resting position is where the glenohumeral joint is at 55 to 70 degree of adduction from the plane of scapula(11) while the neutral position is where medial border and shaft of humerus are parallel to each other under neutral rotation(10). For common postures, subjects lie supinely, and a strap is applied for stabilizing; and the hand is placed high in the axilla with the forearm placed across the body. The other limb is used only to support the subject's upper limb and maintain the resting position.

While pulling at Grade distraction Ⅲ, an assistant took measurement with ultrasound and captured the distraction distance of the joint capsule. And after drawing a virtual line between the end of clavicle and axillary fold, it was to check the humeral head by connecting the transducer at the middle of the virtual line. During the measurement, a plenty of Gell was applied to linear transducer of MyLab One(Esaote co. Natherland); and extra care was taken to deliver constant pressure in order not to apply too much pressure on the region to measure. The measurement was taken with transverse scan. At 40 seconds after pulling the arm, it was to measure the distance between humeral head and the center of glenoid fossa in order to attain the mean value.

Data analysis

For the analysis of data, statistical data processing program, Window SPSS 20.0, was employed. And in order to identify the discrepancies of the distraction distances based on the level of traction amongst the three groups, one-way anova was performed; and LSD was used for the post verification. Significance level was set at α=0.05.

RESULTS

Prior to pulling, neutral position, resting Position and end-range position represent 0.48±0.26mm, 0.62±0.29mm and 0.27±0.22mm respectively.

Resting position showed the highest value, and there was no significant difference among the groups. After pulling, neutral position, resting position and end-range position showed .50±.25mm, .67±.29mm and .35±.21mm respectively where significant difference was detected between resting position and end-range position($p<.05$); but on the other hand, there was no significant difference between neutral position and end-range position and between neutral position and resting position. In other words, the distraction distance at end-range position(.35±.21) was significantly bigger than the distraction distance at resting position (.67±.29) ($p<.05$).

Table 1. Effects of joint position on the distraction distance in glenohumeral joint Traction

Group	Before	After
End-range position(mm)	.27±.22	.35±.21†
Resting position(mm)	.25±.29	.30±.29
Neutral position mm)	.28±.26	.30±.25†

The values were expressed as the mean±SD.
† Significant difference between resting position and end-range position($p<.05$).

DISCUSION

This study was conducted to investigate the distraction distance in the shoulder joint capsule by applying the Grade Ⅲ of Kaltenborn-Evjenth traction to the end-range position, resting position and neutral position of the shoulder of patients with adhesive capsulitis of glenohumeral joint. Consequently, prior to pulling, neutral position, resting position and end-range position showed .48±.26mm, .62±.29mm and .27±.22mm respectively, where the resting position delivered the highest value while the end-range position with the lowest; however, there was no significant difference amongst the groups. After the pulling, significant difference between the resting position group and end-range position group was detected ($p<.05$); however, there was no significant difference between the neutral position group and end-range position group, and no significant difference was not discovered between the neutral position group and resting position group, either.

Lee(12) examined shoulder joints of 48 patients with frozen shoulder with ultrasound and found that the thickness of axillary fold statistically significantly reduces as abduction of shoulder joint and external rotation increases($p<.001$).

This study also learned that the gap of the joints were narrowed as the Resting Position, Neutral Position and End-Range Position showed .62±.29mm, .48±.26mm and .27±.22mm respectively; and it suggests that the increase of thickness of glenoid fossa synovium is associated with limited exercise of shoulder joint traction and external rotation (13).

According to the study by Paul et al.(14), 100 patients with frozen shoulder were selected and subdivided into an experiment group and control group of 50 subjects each, where traditional physical therapy was conducted on the control group whereas traditional physical therapy and countertraction were performed on the experiment group. As a result, significant difference was detected from the shoulder joints of the experiment group, which suggests that countertraction is effective to patients with frozen shoulder. Based on the study by Muraki(15), traction movement was delivered to the adhesive capsulitis of glenohumeral joint of 9 cadavers at zero degree and 30 degree of traction position; and it was reported that it was safely performed since there was a significant difference in distraction interval at 30 degree traction position. Henricus et al.(16) found that after distraction treatment at end-range position was applied to patients with frozen shoulder, the capacity of joint capsule was increased from 10cc to 15cc in 3 months, and shoulder function was improved; thus, it reported that the treatment at the end-range position was effective. In order to elevate mobility of joints, distraction treatment or mobilization exercise of Grade Ⅲ at the resting position needs to be applied(11); and for the increase of ROM, it is effective to perform distraction treatment at the end-range position(10, 17).

Since the resting position carries more loosened tissue than the end-range position, it was expected that the extent of traction at the end-range position, where the level of tissue tension is severely increased, would be bigger; however, the results proved to be otherwise. It is believed that it was because periarticular tissue stretches easier at the end-range position than at the resting position. At the resting position, its distraction interval was longer than that of neutral position; and it was believed to be because the rotator cuff wrapping around the joint at neutral position and middle glenohumeral ligament are contributing structures

which prevents forward dislocation.

Based on these findings, it was evident that the distraction distance varies depending on the location of the joint. And because the end-range position provides better traction treatment effects than the resting position, continuing and repetitive studies on this subject are bound to deliver more interesting results.

This study was performed in order to examine the distraction interval of shoulder joint capsule by applying the Grade Ⅲ of Kaltenborn-Evjenth traction to the resting position, neutral position and end-range position of the shoulders of patients with adhesive capsulitis of glenohumeral joint. It is believed that further studies including blind study, randomized study and controlled study need to be conducted upon more patients with adhesive capsulitis of glenohumeral joint throughout wider range of age groups.

CONCLUSION

In this study, the Grade Ⅲ of Kaltenborn-Evjenth traction was applied at the end-range position, resting position and neutral position of shoulders of patients with adhesive capsulitis of glenohumeral joint; and consequently, it was found that there was a significant difference between the resting position group and end-range position group($p<.05$).

REFERENCES

1. DUPLAY S. Rupture souscutanee du tendon du long extensor du ponce. Bull Mem Soc Chir Paris 1876; 2: 788.
2. Parsons JL, Shepard WL, Fosdick WM. DMSO an adjutant to physical therapy in the chronic frozen shoulder. Ann N Y Acad Sci. 1967;141(1):569-71.
3. Griggs SM, Ahn A, Green A. Idiopathic adhesive capsulitis. A prospective functional outcome study of nonoperative treatment. J Bone Joint Surg Am. 2000;82-A(10):1398-407.
4. Charles A, Rockwood Jr., Frederick A, Matsen, Michael A. Wirth. Rockwood and Matsen's The Shoulder 2 Volume. Saunders; 4 edition., 2009.
5. Rizk TE, Christopher RP, Pinals RS. Adhesive capsulitis (frozen shoulder): a new approach to its management. Arch Phys Med Rehabil. 1983;64:29-33.
6. Jürgel J, Rannama L, Gapeyeva H, Ereline J, Kolts I, Pääsuke M. Shoulder function in patients with frozen shoulder before and after 4-week rehabilitation. Medicina (Kaunas). 2005;41(1):30-8.
7. Nicholson GG. The effects of passive joint mobilization on pain and hypomobility associated with adhesive capsulitis of the shoulder. J Orthop Sports Phys Ther. 1985;6(4):238-46.
8. Watson-Jones R, Simple treatment of stiff shoulder. J Bone Joint Surg Br. 1963;45:207,.
9. Kaltenborn FM, Mobilization of the Extremity joints. Examination and Basic Treatment Techniques. Osio , Norlis Bokhandel. 1980.
10. Hsu AT, Ho L, Ho S, Hedman T, Joint position during anterior-posterio glide mobilization: its effect on glenohumeral abduction range of motion. Arch Phys Med Rehabil. 2000;81:210-214.
11. Kaltenborn FM, Manual Mobilization of the Extremity Joints. Oslo, Norway: Olaf Norlis Bokhandel. 1989.
12. Sang-il Lee, Diagnostic Value of Sonographic Evaluation Using an Axillary Approach in Adhesive Capsulitis of the Shoulder. The graduate school of the universuty of Ulsan. 2013
13. Emig EW, Schweitzer ME, Karasick D, Lubowitz J. Adhesive capsulitis of the shoulder: MR diagnosis. AJR Am J Roentgenol. 1995;164(6):1457-9.
14. Paul A, Rajkumar JS, Peter S, Lambert L. Effectiveness of sustained stretching of the inferior capsule in the management of a frozen shoulder. Clin Orthop Relat Res. 2014;472(7):2262-8.
15. Muraki T, Aoki M, Uchiyama E, Miyasaka T, Murakami G, Miyamoto S. Strain on the repaired supraspinatus tendon during manual traction and translational glide mobilization on the glenohumeral joint: a cadaveric biomechanics study. Man Ther. 2007;12(3):231-9.
16. Henricus M Vermeulen, Wim R Obermann, Bart J Burger, Gea J Kok, Piet M, Cornelia HM. Capsulitis of the shoulder joint: a multiple-subject case report. Phys Ther. 2000;80;1204 - 1213.
17. Edmond SL. Manipulation and mobilization; extremities and spinal techaniques(1st ed). Mosby. 1993