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## TOTAL END RANGE TIME AND MAITLAND'S ANTERO - POSTERIOR GLIDE MOBILIZATION IN FROZEN SHOULDER OF TYPE II DIABETIC SUBJECTS

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### Abstract

In many physical therapy programs for subjects with frozen shoulder, mobilization has been the primer. The restored ROM by mobilization many times has disappeared again, So in order to establish a tool which can provide us a technique with permanent restoration joint ROM, this study compares the efficacy of TERT and Mobilization. The study design is Prospective Experimental study design. Outcome measures are the Shoulder Pain and Disability Index (SPADI) and Baseline goniometer measurement (AASO). The method of study is done by taking 57 subjects who met the criteria's were randomized into two groups group A and group B. Group A received mobilization with gleno-humeral AP glide and Group B were received TERT technique for 4 weeks (20sessions). Pre and Post test measures were recorded. The data were compared and analyzed using paired and independent 't' test, 5 % level of probability was used to indicate statistical significance. The data were analyzed using 't' test. Overall, subjects in both the group improved over 4 weeks. Statistically significant greater change scores were found in group B for SPADI and for external rotation and abduction. The mean of (SPADI scores) pain, disability, total and (ROM) external rotation, abduction showed difference between pre and post test with in group A( Pain pre 38.39, post32.71 Disability index pre38.15, post30.08 ER pre 36.71, post44.14 Abduction pre87.54, post102.32), group B (Pain pre38.03, post29.86, Disability index pre 36.85, post27.46, ER in 90° abd pre 37.76, post 55.34, Abduction pre84.83, post110.17). There was a significant difference between the groups  $p < 0.05$ ). Four weeks of total end range time training and mobilization in subjects with frozen shoulder proved to be effective, TERT showed significant improvement in comparison with mobilization. So, even in the absence of expertise it can be performed with a TERT tool.

**Keyword:** Range of motion ROM, Frozen shoulder, TERT, A-P glide mobilization.

### Introduction

Diabetes is a global non communicable epidemic disease, which according to WHO has affected an estimate of 285 million people (2010), with Type II Diabetes making 90% of the cases<sup>2</sup>. Its incidence is increasing rapidly, and by 2030, this number is

estimated to almost double. The greatest increase in prevalence is however, expected to occur in Asia and Africa where most patients will probably be found by 2030.

Diabetes can affect the shoulder in several ways. First, adhesive capsulitis, or frozen shoulder, has been reported in 19% of type II diabetic patients. This term refers to a stiffened glenohumeral joint

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usually caused by a reversible contraction of the joint capsule. Patients report shoulder stiffness, along with decreased range of motion<sup>1</sup>. Lunbaek (1957) was the first scholar to have identified the correlation between adhesive capsulitis and diabetes mellitus and the incidence was two to four times higher in diabetic patients leading higher rate of morbidity. Cyriax (1975) described the typical capsular pattern in frozen shoulder being the most limited with pain and limits activities of daily life<sup>5</sup>. Review of recent study reveals that the exact reasoning for diabetes induced frozen shoulder is not clear, yet several scholars believe that the impact of advanced glycosylated end products (AGEs) on collagen has a role to play. Its paramount importance to realize that shoulder pain and stiffness impacts on the physical functioning, it also contributes significantly to the emotional and psychological distress of the patients. Furthermore, it imposes considerable financial burden on the affected individual and the society<sup>2</sup>.

Many studies have determined about the prognostic factor of diabetic related shoulder disorders like age, severity of pain, duration of symptom, hand dominance, education and treatment of choice. Zheng et al 2005 specifically investigated the outcome of patients treated conservatively for shoulder disorders. A wide array of physical therapy techniques are commonly used to treat frozen shoulder in diabetic subjects among which the efficacy of passive joint mobilization (Maitland) application of oscillatory movements of the joint in various available ranges is established and total end range time TERT, which is an application of low-load prolonged stress more commonly used in small joints of hand with fruitful results in restoring ROM. The purpose of this study was to compare the efficacy of passive mobilization (Maitland) and Total end range time (TERT) in restoring function of frozen shoulder in diabetic subjects.

## Material and methods

### Subjects

A total of 69 Type 2 diabetic subjects with frozen shoulder were initially recruited of which twelve subjects were excluded; 11 of them did not fulfill the inclusion criteria, and one declined to participate for personal reasons. Thus, 57 subjects entered the study and were randomly assigned to either mobilization group A (n=28) or TERT group B (n=29). The inclusion criteria's were type 2

diabetic, unilateral condition,  $\geq 50$  % loss of passive range of motion (of either abduction, external rotation, forward flexion) of the shoulder joint relative to the unaffected side, duration of complaint for  $\geq 2$  months. Exclusion criteria's were previous manipulation under anesthesia of the affected side, other conditions involving shoulder, intra articular injection in the past 15 days. The recruitment trials were conducted in various out patient clinics in Chennai, and all subjects gave informed consent.

### Outcome measures

Each subject was examined to decide their inclusion by the secondary investigators who were blinded to group allocations. The primary outcome measure employed shoulder pain and disability index (SPADI)<sup>6</sup> self-administered questionnaires that consist of two dimensions, one for pain and the other for functional activities, and require 5 to 10 minutes to complete and a baseline goniometer measurement of Passive range of motion of glenohumeral abduction in coronal plane and external rotation in 90° abduction<sup>17</sup>. Both the chosen outcomes possess high ICC values. Prior to intervention for all subjects, a pre scores were recorded and after an intervention period a post assessment was taken, to avoid bias all investigators used same type baseline goniometer and ensured that prom of movements were measured in cardinal planes in supine lying.

### Intervention

All treatments were done by two groups of physical therapist assisted by post graduate students in assessments. The therapist who performed gleno humeral mobilization has a manual therapy background. Subjects were instructed to perform warm up exercise for 5 min which specifically targets the involved area. The group A patients were positioned appropriately on the treatment table in supine lying then lateral distraction was given with shoulder in neutral position followed by Antero-posterior glide given at shoulder joint line for 15 repetition for 5 times for 20 minutes and subjects were treated for 4 weeks, four day per week, 2 sessions a day, 20 min per session. The group B subjects were made to lie supine on a couch, the intensity of TERT stretch is subjectively based on the subjects pain tolerance, the duration is 20 min per session with 2 sessions per day, 4 days per week for 4 weeks. In TERT the subjects were

made to lie supine, with the affected arm cuffed at mid humeral level TERT strap is pulled to keep the joint in end range of available ROM for 20 min/day, for 2 sessions per day, for 4 days per week.

### Data analysis

Data analysis was done using SPSS software version 16.0. All the dependent variables pain, disability, external rotation and abduction within group A and group B were analysed using paired 't'test. The variables pain, disability, external rotation and abduction between the groups A and group B were analysed using independent 't'test. Statistical significance was set at ( $p < 0.05$ ) level.

### Result

The mean value of table 1 shows that comparison of variables of pre and post-test scores of pain and disability index of group A changed 11.58%, 10.10% respectively. Table 2 shows 16.34% and 11.74% prognostic changes in group B in mean number of pain and disability index. The mean difference of 11.20 in external rotation clearly states that significant difference between groups does exist with a t value of 5.13. The independent t test performed between the groups (Table 3) clearly proves that there is a significant difference between the groups with the t value of 5.9 and P value of .000 for the Shoulder Pain and Disability Index (SPADI) total scores and the other notable thing is abduction improved in both mobilization group and TERT group.

**Fig. 01: Total end range time( tert)**



**Fig. 02: Mobilization AP glide**



**Table No. 01: Paired t test analysis for group a (mobilization) n=28**

OUTCOMES	PRE TEST		POST TEST		95% CI		df	't' value	P value
	Mean(SD)	SEM	Mean(SD)	SEM	Lower	Upper			
<b>SPADI</b>									
Pain	38.39(2.6)	.492	32.71(2.3)	.433	5.150	6.207	27	22.057	.000
Disability	38.15(2.7)	.517	30.08(3.4)	.639	6.929	9.208	27	14.532	.000
Total	38.27(1.8)	.336	31.39(2.1)	.399	6.148	7.599	27	19.43	.000
<b>PROM</b>									
ER in 90° abd	36.71 (7.4)	1.40	44.14(7.14)	1.35	-8.262	-6.595	27	-18.279	.000
Abduction	87.54(12.7)	2.41	102.32(11.34)	2.14	-17.250	-12.321	27	-12.310	.000

ER-External rotation, abd-abduction, Level of significance p<0.05

**Table No. 02: Paired t-test analysis for group B (tert) n=29**

OUTCOMES	PRE TEST		POST TEST		95% CI		df	't' value	P value
	Mean(SD)	SEM	Mean (SD)	SEM	Lower	Upper			
<b>SPADI</b>									
Pain	38.03(2.7)	.495	29.86(2.1)	.393	7.292	9.053	28	19.006	.000
Disability	36.85(3.5)	.643	27.46(1.9)	.359	8.317	10.475	28	17.836	.000
Total	37.44(2.0)	.375	28.66(1.3)	.242	8.105	9.463	28	26.513	.000
<b>PROM</b>									
ER in 90° abd	37.76(7.3)	1.35	55.34(9.2)	1.70	-19.556	-15.616	28	-18.286	.000
Abduction	84.83(16.4)	3.05	110.17(15.5)	2.87	-27.883	-22.807	28	-20.456	.000

ER-External rotation, abd-abduction, Level of significance p<0.05

**Table No. 03: Independent t -test for group 1 and group 2**

OUTCOMES	Mean diff	df	t	P value
Pain	2.85	55	4.884	.000
Disability	2.62	55	3.606	.001
Total	2.73	55	5.914	.000
ER in 90° abd	-11.20	55	-5.138	.000
Abduction	-7.85	55	-2.176	.035

Level of significance p<0.05

## Discussion

In this study comparing the effectiveness of graded mobilization and total end range over time principles for treating unilateral frozen shoulder in diabetic subjects. It appeared that group A subject who were treated with mobilization appeared to have restored functional activity and range of motion of gleno humeral joint. However, the differences were small in comparison with group B treated with TERT technique. Joint mobilization techniques are assumed to induce various beneficial effects<sup>4</sup>. The neuro physiological effects are based on the stimulation of peripheral mechanoreceptors and inhibition of nociceptors and

mechanical aspect of mobilization would help in realigning collagen, restore fibre gliding and enhancing cartilage nourishment.

The primary rationale of TERT group to have exhibited a substantial improvement in rom could be based on the biological principle that periarticular connective tissue will remodel overtime, in response to the duration and intensity of prolonged physical stress (stretching). The biological phenomenon of remodeling occurs over a brief period of time in contrast with the mechanical induced changes that occurs in few seconds (mobilization) Dempsey AL, Mills 2011. This could be the concrete reason why the TERT group showed more prognosis than the other

group<sup>15</sup>. Considering the advantages and efficacy of TERT technique further studies can be done on developing specific TERT protocols and inventing new easy use home based TERT devices.

### Conclusion

Total end range time is an effective rehabilitation tool in treating frozen shoulder subjects with diabetes. SPADI scores and goniometry measurements shows a significant gain in disability index and range of motion. The advantage of TERT to be used as home-based exercise programs with no compromise in the effectiveness will definitely make TERT as an evidence-based treatment choice in frozen shoulder subjects.

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### References

1. Fung ycb.elasticity of soft tissue in simple elongation.am j physiology 1967;213:1532-1544.
2. Balci N, Balci MK, et al S. Shoulder adhesive capsulitis and shoulder range of motion in type II diabetes mellitus:. *J Diabetes complications*.1999;13:135-140.
3. Tighe CB, Oakley WS Jr The prevalence of diabetic condition and adhesive capsulitis of shoulder, *South med J*, Jun;101(6) :591-5, 2008.
4. Maitland GD. Treatment of the glenohumeral joint by passive movement. *Physiotherapy* 1983; 69: 3–7.
5. Cyriax J. Textbook of orthopedic medicine. Diagnosis of soft tissue lesions. 7th ed. Vol 1. New York: Macmillan Publishing Co; 1978.
6. Roach KE, Budiman-Mak E, Songsiridej N, et al. Development of a shoulder pain and disability index. *Arthritis Care Res*. 1991 Dec;4(4):143-9.
7. MTilliamsJ W, Holleman DR. Simel DL. Measuring shoulder dysfunction with the Shonlder Pain and Disability Index. *J Rheumatol*. 1995;22:727-732.
8. Einar Kristian Tveitå et al. Responsiveness of the Shoulder Pain and Disability Index in patients with adhesive capsulitis. 2008;9:161.
9. Heuricus M Vermeulen et al. End range mobilization techniques in adhesive capsulitis of the shoulder joint: A multiple subject case report.2000;80(12):1204-1213.
10. Placzek JD, Lukens SC, Badalanmenti S, et al. Shoulder outcome measures: a comparison of 6 functional tests. *Am J Sports Med* 2004;32:1270-7.
11. Davies GJ, Ellenbecker TS: Focused exercise aids shoulder hypomobility. *Biomechanics*; 1999, 77-81.
12. Yan SF, Ramasamy R, Naka Y, Schmidt AM. Glycation, inflammation, and RAGE: a scaffold for the macrovascular complications of diabetes and beyond. *Circ Res*. 2003; 93: 1159–1169.
13. Vermeulen HM, Obermann WR, Burger BJ, Kok GJ, Rozing PM, van Den Ende CH. End-range mobilization techniques in adhesive capsulitis of the shoulder joint: a multiple-subject case report.*Phys Ther* 2000;80:1204-13.
14. Angst F, Goldhahn J, Pap G, Mannion AF, Roach KE, Siebertz D, et al. Cross-cultural adaptation, reliability, and validity of the German Shoulder Pain and Disability Index (SPADI) *Rheumatology (Oxford)* 2007;46:87–92.
15. McClure P, Blackburn L, Dusold C: The use of splints in the treatment of joint stiffness: biologic rationale and an algorithm for making clinical decisions. *Phys Ther* 1994;74:1101.
16. Janda DH, Hawkins RJ. Shoulder manipulation in patients with adhesive capsulitis and diabetes mellitus: a clinical note. *J Shoulder Elbow Surg*. 1993;2:36–38.
17. 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: 238-246.
18. Boone Dc. Reliability of goniometric measurements. *Phys therapy* 1978; 58: 1355.