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Update on PHYSICAL THERAPY™

WINTER
2007

Active Exercises Improve Outcome Following Whiplash Injury

Neck pain, headache and shoulder pain are common symptoms associated with whiplash injuries. Immobilization of the cervical spine with a soft collar as well as treatment with nonsteroidal anti-inflammatory drugs (NSAIDs) is common treatment for whiplash injury. However, symptoms have been shown to persist longer than 6 months for patients treated with a soft collar.

The aim of the study conducted by Vassiliou et al from University Hospital Marburg, Germany, was to compare the effect of a physical therapy (PT) regime (including active exercises) with the current standard practice employing immobilization with a soft collar on reducing pain and disability 6 weeks and 6 months after injury. Two hundred patients who presented with whiplash injuries grades I or II (Quebec Task Force classification) within 48 hours after injury were randomly assigned to 1 of 2 treatment groups.

In the standard group, treatment consisted of immobilization with a soft collar that was to be worn continuously for 7 days. In the PT group, patients were scheduled for 10 PT sessions within the first 14 days after injury. Both groups were provided oral medications.

PT included heat, lymph drainage, massage and active exercises for the neck and shoulder with an elastic resistance band. A home program of active exercises was also given for the first 14 days after injury. Clinical assessment of pain intensity and disability was performed at the time of enrollment in the study and at

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1 week, 6 weeks and 6 months after the initial enrollment. Pain and disability were rated with pain diaries utilizing a 0–10 scale.

No significant difference in mean pain intensity between the standard treatment group (4.76 ± 2.15) and the PT group (4.36 ± 2.14) was found after the first week. However, after 6 weeks, mean pain intensity was significantly lower in the PT group (1.49 ± 2.26) than in the standard treatment group (2.70 ± 2.78; $p = .002$). Similarly, after 6 months, significantly less pain was reported in the PT group than in the standard treatment group (1.17 ± 2.13 vs 2.33 ± 2.56; $p < .001$). Differences between the groups regarding the incidence of trauma-related disturbances became evident after 6 weeks and 6 months. This was particularly the case for neck pain, headache and shoulder pain. The presentation of symptoms in each group for those patients returning after 6 months is found in Table 1. The results of this study indicate that a PT regimen of active exercises is superior to a treatment of immobilization with a soft collar in reducing pain and disability 6 weeks and 6 months after whiplash injury.

Vassiliou T, Kaluza G, Putzke C, et al. Physical therapy and active exercises—an adequate treatment for prevention of late whiplash syndrome? randomized controlled trial in 200 patients. Pain *2006;124:69-76.*

Conventional vs Heavy Resistance Exercises

Muscle wasting and loss of muscle strength are major problems linked to knee joint injuries. Central activation failure, or loss of neuromuscular activation, has also been reported after knee joint injuries. Thus, exercises that may stimulate hypertrophy as well as increase neural drive should be used during rehabilitation. To address these issues, Andersen et al from the National Institute of Occupational Health, Denmark, examined the level of knee joint neuromuscular activation with electromyography (EMG) during conventional therapeutic exercises vs heavy resistance exercises. Thirteen healthy males with a mean age of 25 years were studied.

Neuromuscular activation was examined during 4 conventional therapeutic exercises (quadriceps femoris muscle setting, manual lateralization of the patella, rhythmic stabilization and pelvic bridging) and 4 heavy resistance exercises (free weight squat with a barbell, horizontal seated leg press, isolated knee extension with a cam mechanism and isolated hamstring curl). The heaviest weight that could be lifted 10× in a controlled manner (i.e., 10-repetition maximum) was determined for each heavy resistance exercise.

Peak EMG amplitude was recorded during maximum voluntary isometric contractions performed for the knee extensor, knee flexor and hip extensor muscles. Neuromuscular activation during the exercises was then defined as the root mean square (RMS) EMG signal normalized to the peak RMS EMG signal of the maximum voluntary contraction of the respective muscles. The data were averaged over 5 repetitions and 3 sets for each exercise.

The quadriceps muscle setting exercise produced the highest level of activation among the conventional exercises; however, these levels of neuromuscular activation were relatively low (<35%) when compared with the heavy resistance exercises. Highest

Table 1. ***Presentation of symptoms after 6 months***

Symptoms	Study participants $n = 124$	Standard treatment $n = 52$	PT group $n = 72$
Neck pain	35 (28.2)	20 (38.4)	15 (20.8)
Headache	12 (9.6)	9 (17.3)	3 (4.1)
Shoulder pain	17 (13.7)	12 (23)	5 (6.9)
Back pain	2 (1.6)	2 (3.8)	0 (0)
Limb pain	2 (1.6)	0 (0)	2 (2.7)
Paresthesia	4 (3.2)	1 (1.9)	3 (4.1)
Visual disturbance	2 (1.6)	2 (3.8)	0 (0)
Tinnitus	0 (0)	0 (0)	0 (0)
Dizziness	2 (1.6)	1 (1.9)	1 (1.3)

neuromuscular activation (range, 67–79%) was found for the heavy resistance exercises of isolated knee extension and hamstring muscle curl.

The conventional exercises of this study may be helpful to lessen muscle wasting during periods of immobilization when dynamic exercises are not possible or contraindicated. When increased neuromuscular activation is required, heavy resistance exercises need to be incorporated into rehabilitation programs. However, the safety aspect of heavy resistance exercise in relation to rehabilitation cannot be overlooked.

Andersen LL, Magnusson SP, Nielsen M, et al. Neuromuscular activation in conventional therapeutic exercises and heavy resistance exercises: implications for rehabilitation. Phys Ther *2006;86: 683-697.*

Shoulder Dysfunction And Outcomes in Outpatient PT

Individuals with shoulder dysfunction are commonly seen in physical therapy (PT). This suggests the need for a comprehensive, useful classification system.

Millar et al from Andrews University, Michigan, conducted a retrospective analysis of 878 patients who had been referred to PT for shoulder dysfunction over a 4-year period. Prior to inception of the shoulder patient database, protocols were standardized with all therapists for consistency across the 4 regional outpatient clinics from which the data were gathered.

TABLE 2. ***Descriptive data for age in years and gender distribution by shoulder category***

	Age	Gender	
Shoulder category	**Mean ± SD**	**Females (*n*)**	**Males (*n*)**
Impingement ($n = 469$)	52.1 ± 15.4	268	201
Rotator cuff tear ($n = 63$)	61.3 ± 13.3	26	37
Frozen shoulder ($n = 75$)	58.6 ± 13.7	49	26
Postoperative ($n = 156$)	51.9 ± 14.7	56	100
Instability ($n = 26$)	30.6 ± 20.3*	15	11
Fracture ($n = 18$)	58.4 ± 17.6	12	6
Miscellaneous ($n = 41$)	44.1 ± 17.8	23	18
Total ($N = 848$)	52.4 ± 16.2	449†	399

*Significantly different from all other categories ($p < .05$).
†Significantly different distribution of females throughout the categories compared with males ($p < .05$).

Shoulder dysfunction was classified into 7 categories based on evidence-based criteria for that particular classification: impingement, rotator cuff tear, postoperative, instability, fracture, frozen shoulder or miscellaneous. Subcategories were also identified within these major categories and included descriptors such as type of restriction, initial incident and type of surgery or instability.

Standardized clinical and functional measurements were obtained at admission and at discharge. These included clinical tests of range of motion (ROM) and strength as well as functional measures of work status and disability. Interventions for each patient were based on individual impairment and function, and were consistent with the *Guide to Physical Therapist Practice*. Thus, interventions included exercise, manual therapy, ultrasound, phonophoresis, electrical stimulation, iontophoresis, ice, heat and patient education.

Table 2 shows the distribution of patients by age and gender within each shoulder category. Fifty-five percent of patients had shoulder impingement, followed by 18% with postoperative repair. The average patient age was 52.4 years, and patients averaged 13.7 PT treatments.

Improvement in both clinical and functional measures was found across all categories of shoulder dysfunction following PT intervention. Shoulder flexion and abduction showed the greatest magnitude of change for ROM, followed by increased passive external rotation in 90° of abduction. Upon admission to PT, more than half of the patients in the postoperative, fracture, rotator cuff tear and miscellaneous groups were off-work or on restricted duties. Following intervention, this number decreased to <30% of patients hav-

ing restrictions. As noted by the authors, it is not possible to determine from this retrospective analysis whether these changes were due to intervention or time.

Classification of shoulder dysfunction in a manner presented by these authors may provide practitioners with practical knowledge regarding the scope of impairments, clinical presentations and expected outcomes for the different types of shoulder problems that are encountered in outpatient PT practices.

Millar AL, Jasheway PA, Eaton W, Christensen E. A retrospective, descriptive study of shoulder outcomes in outpatient physical therapy. J Orthop Sports Phys Ther *2006;36:403-414.*

What Factors Impact Disability in Low Back Pain?

Low back pain (LBP) is the most frequently noted primary diagnosis associated with patient visits to physicians' offices and the most common reason that patients seek outpatient physical therapy (PT) services. In addition to the primary goal of pain relief, restoration of function and change in disability status are equally significant outcomes following rehabilitation. To date, few studies have assessed the factors that may influence outcome of PT interventions.

Badke and Boissonnault from the University of Wisconsin Hospital and Clinics assessed the impact of symptom duration on functional outcome and improvement, pain and patient perception of recovery following PT intervention. In this retrospective medical record review, 133 patients treated for LBP at 4 different outpatient orthopedic clinic sites were identified. The patients were divided into 3 groups based on symptom duration. The acute group began PT within 1 month post symptom onset; the subacute group began PT between 1 and 6 months post onset; and the chronic group began PT later than 6 months post onset.

All patients had received a customized rehabilitation program consisting of mobilization/manipulation, flexibility and strengthening exercises, massage techniques and heat/cold modalities. The number of visits ranged from 5–8 for each group over a duration ranging between 7.7 and 11 weeks for the acute and chronic groups, respectively.

The CareConnections Outcomes System (formerly the TAOS database) was used to assess functional improvement and functional outcome as well as perceived pain and improvement, as reported by the patient. No significant differences were found between groups at the initial assessment. However, significant differences were found between pretreatment and posttreatment function scores within each of the groups. Greatest functional and perceived improvement were found in patients whose symptoms lasted <1 month.

A regression analysis was also used to determine whether any of the intervention combinations (flexibility, strengthening, mobilization/manipulation) or patient variables (age, initial function, symptom duration) would aid in predicting functional improvement. The author's study findings show that age ($p = .001$), symptom duration ($p = .002$), and inclusion of strengthening, flexibility and mobilization/manipulation ($p = .001$) together explained approximately 55% of the variance in functional improvement score.

The results of this study underscore the importance of appropriate PT interventions and the optimal timing of therapy services in maximizing functional outcomes in patients with LBP.

Badke MB, Boissonnault WG. Changes in disability following physical therapy intervention for patients with low back pain: dependence on symptom duration. Arch Phys Med Rehabil *2006;87:749-756.*

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