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Repetitive strain injury: A new definition and treatment strategy based on the client-centered practice

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Abstract

RSI is defined by the authors as a biopsychosocial disorder, under the umbrella of cumulative trauma disorder, involving a non-specific, potentially chronic pain syndrome of the upper extremity. Evaluation and treatment will focus on the client-centered practice. Patients are enrolled in an 8-week course of treatment, which focuses on patient involvement, education, relaxation, diaphragmatic breathing, exercise, postural modification, as well as assessing vocational and psychosocial issues. Copyright © 1997 Elsevier Science Ireland Ltd.

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1. Introduction

There has been a recent rise in cumulative trauma disorders (CTD). In addition to commonly accepted disorders, such as carpal tunnel syndrome, patients are seen suffering from a less well-defined syndrome-repetitive strain injury. Therapists treating cumulative trauma disorders, such as lateral epicondylitis or deQuervain's, use a biomechanical frame of reference. Diagnosis is the foundation for an appropriate treatment plan, and treatment outcome can generally be pre-

dicted. With repetitive strain injury (RSI), the mode of treatment is not clear because the diagnosis is not clearly understood or even universally accepted. Many patients with this diagnosis do not improve with traditional therapy, work/activity modification or surgery. Furthermore, controversy exists as to whether RSI is a specific condition, how it should be treated, and who should pay for treatment.

1.1. Literature review

The literature reflects the ongoing debate regarding nomenclature, potential legitimacy, etiology and treatment of RSI. Damian Ireland, a

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physician from Australia, gave his opinion in the mid 1980s that RSI may be a sociopolitical phenomenon, and not a medical condition (Ireland, 1988). He proposed that the pain experienced with RSI is not due to the physical work demands, but rather to the psychological stress of the job (Ireland, 1995). Others from Australia have suggested that neurophysiological changes may be present, and that the pain cycle will not be broken with physical treatment alone (McIndoe and Littlejohn, 1995).

In the United States, many terms are used to describe occupational pain disorders. The *Journal of Hand Surgery* has had strong articles and rebuttals discussing differing views on the etiology and treatment of CTD, RSI, occupational arm pain, and overuse syndrome—terms used interchangeably. Mackinnon and Novak described physical symptoms that are associated with 'non-specific pain syndrome'. They proposed a hypothesis for pathogenesis of CTD based on abnormal postures, and recognized the problem has multiple components (Mackinnon and Novak, 1994). Nathan et al. (1995) suggested that poor fitness plays an important role, and that cumulative trauma is not the only cause. They further stated that this population does not seem to respond to treatment because the medical community is inappropriately overtreating the symptoms.

1.2. RSI defined

Based on the literature, there are three hypotheses that may justify various approaches to the diagnosis and treatment of RSI: it is emotionally driven; it is physically driven; or it is dually driven by the emotional and physical components.

It has been proposed by the authors that RSI is a biopsychosocial disorder involving a non-specific, potentially chronic pain syndrome of the upper extremity, under the umbrella of cumulative trauma disorders. Patients present with the following characteristics.

1.2.1. Demographics

The majority of patients with RSI are female, 20-40 years of age, and of no specific body type. Physical demands of their work are in the sedentary to light category.

1.2.2. Social-emotional characteristics

There is a tendency to be an over achiever, with a perfectionistic approach to vocational and avocational activity. The patient seeks positive regard from others, tends to be co-dependent, is social by nature, and has an external locus of control (Dadio, 1995).

1.2.3. Physical findings

The patient's pain is diffuse. Paresthesia, dysesthesia and hyperesthesia do not follow a particular dermatomal or myotomal pattern. The patient may complain of distal edema, however, testing does not indicate edema to be present. The symptoms are in the upper quadrant, and may be unilateral or bilateral, but not symmetrical. Rest does not provide consistent relief of the symptoms, and the patient does not respond to traditional therapeutic/surgical interventions for CTDs.

1.2.4. Pathophysiology

Although controversy exists regarding physical vs. emotional etiology of symptoms, it must be acknowledged that patients with RSI present with a combination of neurogenic and myogenic complaints.

Pain from nerve injury is understood in part by sensitization by peripheral modulators and hyperirritability of the corresponding dorsal root ganglion (DRG neurons) (Wall and Devor, 1983; Kajander et al., 1992). Following sensory axonal injury, the DRG becomes hyperexcitable from information it receives from retrograde axonal transport systems, and may initiate neuroma formation (Devor et al., 1989). Could a self-perpetuating cycle of nervous tissue hyperirritability be responsible for pain and dysfunction experienced by the patient with RSI?

Pain may also arise from structures within the musculoskeletal system. Active trigger points may be due to abnormally firing muscle spindles, local trauma to the sarcoplasmic reticulum, or sensitization by noxious metabolites (Travell and Simons, 1983). This portion of the patient's pain is generally concrete and treatable. The diffuse pain associated with RSI, which looks like muscle tenderness that is not sharply demarcated (as in trigger

point tenderness) may not make sense anatomically, and is not so readily treated. Nociceptive afferents found in muscle are irritated by noxious metabolites, and/or extracellular calcium, which occurs secondary to inflammation. These nociceptive afferents may account for the diffuse nature of pain with RSI.

2. Evaluation

The evaluation process is divided into four main areas: (1) demographics, vocational status and psychosocial issues; (2) modified Canadian occupational performance measure; (3) physical data; and (4) compilation of client-centered goals.

2.1. *Demographics, vocational status and psychosocial issues*

The patient is given the responsibility for filling out the demographic and vocational portion of the evaluation. The therapist observes sitting posture, breathing style (diaphragmatic or upper lobe) and pain behaviors. The vocational questions are borrowed from the field of rehabilitation counseling. The patient's response to these questions gives the therapist insight into the patient's current work status and knowledge of the workers' compensation system. Important information related to the financial impact of injury and the patient's role as wage earner, both before and after injury, are recorded. Information gained from this part of the evaluation may prompt a referral to a certified rehabilitation counselor.

The next portion of the evaluation helps to verify the patient's level of insight into the existence and impact of psychosocial issues. The therapist defines self-image, self-concept, and self-confidence, and asks the patient if there has been a change since injury, using an analog scale.

2.2. *Modified Canadian occupational performance measure (COPM)*

The COPM is used to facilitate identification of occupational performance issues, and to promote client-centered practice. It is a measure of the client's self-perception of self-care, leisure, and

productivity (Canadian Occupational Therapy Association, 1991). The patient ranks these three areas of occupational performance on a scale from 1 to 10 for importance, satisfaction and performance. This information is readily tabulated by the therapist (or the patient if appropriate) into a score. The score is used to quantify functional progress or lack thereof; and may also be used to track clinical outcomes.

2.3. *Physical data*

As previously stated, patients present with a combination of myogenic and neurogenic symptoms. Herein lies the challenge when evaluating; how do we associate symptoms to underlying pathology when patients experience discomfort with most or all physical/provocative testing? Clear communication between the therapist and the patient is imperative. The therapist needs to be in tune to patient pain vocabulary and body language. The patient needs to be empowered to stop this portion of the evaluation process if pain is unduly flared. It is important to accept that all information will not be compiled during the first visit in most cases.

Evaluation of the upper extremity includes functional range of motion, gross muscle strength, grip and pinch strength, Semmes-Weinstein monofilaments, and volumetric measurements; and focuses on palpation techniques and provocative tests to clarify the myogenic and neurogenic components of RSI. Differential diagnosis includes ruling out fibromyalgia (Rachlin, 1994); reliability of patient performance (using tests of maximum voluntary effort, such as the grip curve and rapid exchange tests); and more specific cumulative trauma disorders, such as carpal tunnel syndrome or lateral epicondylitis.

Palpation techniques are employed to document trigger points and patterns of referred pain (Travell and Simons, 1983). Diffuse muscle tenderness is also documented. The dolorimeter is a useful tool to quantify pressure pain sensitivity (Rachlin, 1994).

A well-documented problem with many of the provocative tests is that a consistently large number of the normal population will have false-positi-

tive results. The following provocative/special tests are employed with the aforementioned in mind

2.3.1. Nerve-related tests

Foraminal compression testing; Roos overhead stress test; Adson's test for compression of the subclavian artery in the scalene triangle; costo-clavicular maneuver to place pressure on the brachial plexus; upper limb tension testing for brachial plexus, median, radial and ulnar nerves; isolated resistance to FDS to middle and ring for pronator syndrome; resistance to FPL and FDP to index and middle for anterior interosseous syndrome; resistance to middle finger extension for posterior interosseous syndrome; elbow flexion testing for cubital tunnel syndrome; Phalen's and forearm compression for carpal tunnel syndrome; and Tinel's sign.

2.3.2. Tendon-related tests

Yergason's test for the bicep's tendon in the bicipital groove; drop arm test for rotator cuff tears; resisted wrist extension and flexion for lateral and medial epicondylitis; and Finkelstein's test for first dorsal compartment tenosynovitis.

2.4. Client-centered goals

Long- and short-term goals are formulated with active involvement of the patient. A long-term goal under the client-centered practice specific to RSI may look like this: 'The patient will independently manage RSI symptoms to regain functional capacity necessary for performing desired work/activity'. The COPM results are formulated to create functional, client-centered short-term goals. A typical short-term goal may read: 'Patient's satisfaction with performance of self-care will improve from a level 1 to a level 2 in 2 weeks through the use of the RSI Tool Box_{c1995}, activity and behavioral modification techniques'.

3. Treatment/Management

Most often patients suffering from repetitive strain injury have been evaluated and treated by a multitude of physicians and therapists. Histori-

cally, treatment of RSI has been based on the traditional biomechanical frame of reference with little success. As each treatment fails, feelings of frustration and worry, anxiety and fear start to overwhelm the patient. Based on the authors' exposure with this diagnosis, it is concluded that successful outcomes can be achieved if both the biomechanical and the conceptual frames of reference are given consideration when treating a person with RSI. Treatment is based on the client-centered practice, which empowers the patient to become actively involved in the healing process. This approach to treatment supports the notion that people are responsible for their health and well-being.

3.1. How do we begin the empowerment process?

McIndoe and Littlejohn suggest that successful management with this population is dependent on a multidisciplinary team approach. With this approach, the patient is the 'team leader' (McIndoe and Littlejohn, 1995). Patients identify problems, focusing on their own environment. This ensures relevance of the problem to the patient. The team facilitates the patient to focus on the present. The team is vocationally directed, with an emphasis on maintaining or returning the individual to gainful employment. Littlejohn has indicated that this population does not respond favorably to rest, advocating that these patients should not be taken out of work (Littlejohn, 1995). The program involves educating the patient and teaching adaptations to help control physical and emotional symptoms through the use of relaxation (including breathing techniques), exercise, change in attitude, postural modifications, possible change in occupation, and improvement in general health (Littlejohn, 1995; Edgelow, 1993).

4. Treatment guideline

A treatment guideline has been established in an effort to dispel the notion that 'it will never get better and/or it will take years for the pain to go away'. Twelve sessions over an 8-week period of time is recommended. The patient is seen in the clinic two times a week for 4 weeks, then

decreased to one time a week for 4 weeks. A time frame gives the patient a beginning and ending point. This assists patients with the realization that successful treatment is not dependent on another person 'curing' them, but rather 'curing' themselves.

4.1. Session 1

The first session involves the completion of the evaluation, which has already been discussed. Once the therapist compiles the objective findings, a treatment plan is formulated and agreed upon by the patient and the therapist. The patient's long- and short-term goals are established based on the results of the clinical findings and the COPM. If time allows, the patient is introduced to the RSI Tool Box_{c1995}.

4.2. Session 2

Session 2 begins with the introduction of the RSI Tool Box_{c1995}, if it was not introduced in Session 1. The RSI Tool Box_{c1995} was designed by Robyn Stricoff, OTR/L, CHT in an effort to promote the patient empowerment process. The tool box is comprised of, but certainly not limited to: a home exercise program, a relaxation tape, splints, elbow pads, and portable work station equipment. Once the patient understands the concept of the tool box and the tool functions, the patient becomes responsible for utilizing the adaptive devices based on symptoms at that time. The first two tools placed in the box are the relaxation tape and a moist heat pack.

Moist heat and/or paraffin appear to be the modalities of choice with this population. Even though moist heat and paraffin have a temporary effect, the focus of treatment is to empower the patient to control symptoms. Modalities that can be used conveniently at work and home are strongly encouraged. The patient has full control as to where and when to use the modality, removing the responsibility for pain reduction from the therapist.

Other modalities, such as ultrasound and iontophoresis with dexamethasone are used if the patient is complaining of a specific trigger point

or a specific area of inflammation. Patients suffering from RSI usually do not respond favorably to fluidotherapy. This thermal modality seems to increase their sensation of increased distal edema. Cryotherapy does not seem to positively change the patient's symptoms; however, a small percentage of patients do respond favorably. It is recommended that heat be initiated first; if heat does not affect the symptoms, then ice should be tried. However, a precautionary note is that ice may cause activation of trigger points (Travell and Simons, 1983).

The relaxation tape is the next tool to be placed in the box. An instructional tape that incorporates diaphragmatic breathing techniques is strongly recommended. Patients seem to benefit from an instructional tape initially. However, once they become comfortable with relaxation and breathing techniques, patients are encouraged to purchase a relaxation tape of their choice as part of the empowerment process.

Written and verbal instructions regarding the use and application of moist heat (along with safety precautions), and relaxation are thoroughly discussed. Application of moist heat may be applied as many times as the patient deems necessary. Initially, the patient is encouraged to listen to the relaxation tape and follow the techniques two to three times a day. Again, these instructions are guidelines for the patient; the patient is in control of making the decisions based on symptoms.

4.3. Session 3

Anatomy of the upper quadrant is briefly discussed with the patient. The therapist describes the complexity of the nervous system, explaining that all nerves originate in the spinal cord and pass through the neck under the clavicle. It is explained that nerves are prone to being compressed or placed on adverse neural tension in this area as a result of our activity and posture (Butler, 1991). It is helpful to relate a nerve to a cable with many wires running through it. Bending the cable in one place may affect transmission throughout the system. Similar comparisons are taught when discussing tendon anatomy. The use

of diagrams and illustrations is helpful with the educational process.

During the anatomy lesson, the therapist may want to place a hot pack on the patient's area of discomfort. This allows the therapist to accomplish three things: treat, educate, and facilitate problem solving. At this time, the patient should be able to express whether or not the heat is beneficial.

After the brief anatomy lesson, the therapist discusses the relationship between anatomy and posture. Both sitting and sleeping postures are discussed. The patient is asked to examine his/her sitting posture while in front of a mirror. Correct and incorrect postures are demonstrated for the patient. A clavicle strap or comparable device may be used to provide proprioceptive/kinesthetic input to correct the patient's posture. Sleeping in the fetal position is discouraged. Back or side sleeping is discussed with the use of proper pillow placement. If the patient sleeps with the elbows positioned in flexion, an elbow flexion stop may be fabricated. If the patient sleeps with the wrists flexed, a pre-fabricated soft wrist splint may be used. If appropriate, the clavicle strap, elbow flexion stop and/or soft wrist splints may be added to the RSI Tool Box_{c1995}. The patient becomes aware as to which device to employ to influence symptoms.

The patient is instructed in the use of proper body mechanics and joint protection when lifting, carrying, pushing and pulling during work and at home. Many educational tools available on the market may be appropriate to use. Activities of daily living are also discussed in relation to the patient's home and work environment using the COPM as a guide.

Lastly, the patient is introduced to the first phase of exercise to be done as part of the home exercise program (HEP). During the initial stages of treatment, exercises involving static gripping postures and/or activities are to be avoided. Exercises incorporating stretching of the anterior proximal musculature are encouraged. Specific muscles to be stretched may include: anterior scalene, pectoralis minor, pectoralis major, biceps, flexor pronator group, extensor supinator group, thenars and intrinsics.

The 'one-minute wall series' exercise is also introduced (Hansford, 1993). This can be done inconspicuously throughout the day. The exercise includes: chin tuck; scapula retraction; scapula depression; glenohumeral external rotation; and shoulder adduction. The distal extremity remains relaxed with the elbows extended, and forearms, wrists and digits in neutral. Initially, the movements are taught separately, unilaterally and with gravity eliminated. As the patient progresses, the series may be done as one complete exercise. This exercise facilitates awareness of the middle and lower trapezius and rhomboid muscles, which are needed to maintain proper posture. Patients are instructed to perform this exercise throughout the day as they feel necessary. The exercise may be done in the lying, sitting or standing position. Performing this exercise while lying supine or standing against a wall is beneficial when the patient requires additional proprioceptive input. The patient is given a written description of all the exercises for the tool box.

4.4. Session 4

The therapist reviews with the patient the items in the tool box, as well as program compliance. The therapist may apply moist heat to uncomfortable areas while doing the education piece of Session 4. The patient is educated regarding the impact of seated work on the body. A multitude of educational topics may be used. The patient is empowered to take control of the environment by understanding correct and incorrect postures and positions. The therapist introduces the idea of a work station evaluation. An on-site evaluation is strongly encouraged for every patient with RSI, and is performed by a therapist or other qualified individual, such as an employee within the safety department.

Additional work issues discussed are stress-related issues. Stress seems to be an important factor with RSI, and needs to be addressed to successfully treat the patient. It is important to discuss it during all sessions as it applies to daily life. Biofeedback is introduced as a tool to teach stress reduction and is used in the clinic, as well as home and work environments. This modality is

effective in increasing the patient's awareness of muscle activity during tasks and stressful situations (Peper et al., 1994). Peper has established a protocol for the use of biofeedback at the work station. The patient is taught what muscles should be firing and what muscles should be relaxed during a specific activity. This modality allows the therapist and patient to establish a therapeutic baseline, and provides a means of assessing patient awareness and progress. The educational piece regarding the seated worker and the biofeedback unit are placed in the tool box.

4.5. Session 5

The patient is introduced to some form of aerobic activity. Aerobic activity increases circulation, muscle flexibility, endurance, and pain threshold; and decreases muscle tightness (McIndoe and Littlejohn, 1995). This is introduced gradually to avoid patient fear and anticipation of pain. Patients are encouraged to pace the exercise and activity within an achievable context, and make appropriate adjustments within their goals and expectations. Aerobic activity may include walking, swimming, or biking. Exercise is aimed at increasing the heart rate to 60% of the maximal predicted heart rate. The maximal heart rate is generally equal to 220 minus the person's age (Littlejohn, 1995).

A successful exercise program includes: warm-up with stretching of all major muscle groups, non-impact loading, gradual progression of exercise intensity, and recognition on the part of the patient that this is a life long exercise commitment (Farrell, 1995). The patient is encouraged to walk 15-30 min/day. The patient may be resistant to this portion of the program due to time constraints. Non-compliance with the exercise component of the program is not acceptable. Program compliance is obtained when goals are achievable; program compliance equals positive outcomes.

If the patient demonstrates trigger points, self-trigger point release techniques are taught. Self-nerve mobilization is also introduced at this time if the therapist feels the patient is being compliant with the program (Butler, 1991), but should

be taught with caution as it may exacerbate symptoms. Again, these self-treatment techniques place the responsibility for controlling symptoms on the patient.

4.6. Session 6

It is now the end of the third week of treatment. The therapist reviews all exercises, adaptive devices and modifications discussed in previous sessions. The COPM is re-administered to assess progress and establish new treatment priorities.

4.7. Session 7

An on-site work evaluation should be performed no later than the fourth week. A written report with work station modification and recommended adaptive devices is completed. The evaluation and recommendations are discussed with the patient and the employer. If the patient has a home office, the patient is instructed to purchase any needed equipment for the home environment. If appropriate, a home office assessment may be done.

4.8. Session 8

A follow-up work station assessment is completed to ensure appropriate implementation of equipment and to educate the patient on the use of the equipment. The therapist discusses the exercise program with the employer to encourage employer support.

4.9. Session 9

The patient's treatment sessions are decreased to one time a week for 4 weeks. As the patient gains control of symptoms, a strengthening program may be initiated, beginning with isometric exercise, and gradually progressing to isotonic exercise. Strengthening should focus on the gross motor musculature of the upper and lower quadrants, and the antigavity muscles to reinforce correct posture. As part of the strengthening program, the patient is taught to stretch before and after the program, and incorporate muscle relax-

ation after exercise. Contractions should be kept under 5% of maximal voluntary contraction, and ample recovery time must be allowed between contractions. Strengthening the distal extremity, especially with repetition, is to be avoided. Exercises that require a static, sustained grip are to be avoided. Strengthening programs using hand-held free weights, theraband, theraputty, or hand grippers are usually contraindicated.

Precautionary thoughts before initiating a resistive exercise program should be considered. A muscle requires time to recover once resistance is placed on it, even resistance as minimal as gravity. The patient suffering from RSI does not have adequate recovery capacity in the muscle (Farrell, 1995). Muscle fatigue may cause compensatory patterns. Furthermore, the emotional component of this disorder is stress. Stress adds tension; tension causes pain. Strengthening exercises may cause an increase in muscle tension, which in turn may exacerbate pain symptoms. The patient is made aware of this relationship in order to be successful in the self-management program.

4.10. Session 10

All exercises and the RSI Tool Box_{c1995} are reviewed and reinforced. At this time, the patient should be in control of symptoms through the use of education, exercise, postural and behavioral modification, and the use of adaptive devices. The patient should be demonstrating empowerment. At this session, patients are encouraged to add 'fun' into their life. So many people diagnosed with RSI have taken the element of fun out of their everyday existence (Farrell, 1995). Their homework for the week is to do one 'fun' activity before the next therapy session.

4.11. Session 11

The patient is expected to share their 'fun' activity. The program and newly issued strengthening exercises are reviewed. The COPM is re-administered; the therapist and patient review the results, and compare the previous evaluation results with the re-assessment. The discharge process begins.

4.12. Session 12

A review of the entire program occurs. The patient is informed of a resource for obtaining an ADL catalog for future needs. If a support group exists, the patient is given the information. Support groups seem to provide positive reinforcement for patients to maintain themselves on the self-management program. Patients are encouraged to contact the therapist at any time for a refresher course if they feel they are experiencing an exacerbation of symptoms. The patient has, hopefully, achieved the stage of acceptance and taken responsibility for control of symptoms.

5. Conclusions

Successful outcomes with patients suffering from RSI are dependent on our continued research regarding diagnosis, pathophysiology, evaluation and treatment. Patients are best served by a team approach, with treatment that focuses on the whole person, and not just isolated symptoms. Patients must be empowered to take control and responsibility for what is happening to them emotionally as well as physically.

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