

HYDROTHERAPY.

**Review on the effectiveness of its application
in physiotherapy and occupational therapy.**

by
**Dr. Craig W. Martin, Senior Medical Advisor
Kukuh Noertjojo, Health Care Analyst**

(May 2004)

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

TABLE OF CONTENTS	Page
1. Introduction and Objectives	1
II. Material and Methods.....	2
III. Results	2
High level evidence on the effectiveness of hydrotherapy	2
Hydrotherapy and arthritis	2
Hydrotherapy and chronic low back pain	6
Hydrotherapy and ankylosing spondylitis	7
Hydrotherapy and rehabilitation of patients	
With anterior cruciate ligament disruption	8
Hydrotherapy and pressure ulcer healing.....	10
Hydrotherapy and fibromyalgia	10
Interesting application of hydrotherapy among children diagnosed with Complex Regional Pain Syndrome (CRPS) (Evidence level 3-4)	12
Complications due to hydrotherapy.....	12
IV. Summary	13
Appendix 1	14
References	15

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

I. Introduction and Objectives.

Hydrotherapy or hydrotherapeutics is sometimes referred to as hydrophathy⁽¹⁾. It is said to incorporate the use of the “healing powers” of water. Its use dates back to as early as 2400 BC⁽²⁾. Many practitioners of ‘hydrotherapy’ feel water has significant curative properties and that, unlike other medicinal agents, is not harmful nor potentially toxic⁽¹⁾. Thalassotherapy literally means sea therapy. The official definition of thalassotherapy came from the French Sea and Health Federation in 1986. It states “in a privileged marine location, thalassotherapy is the combined use, under medical supervision, and with a curative and preventive goal, of the benefits of the marine environment which include the marine climate, seawater, mud, sand, seaweed and other substances derived from the sea”⁽¹⁾. Balneotherapy or spa therapy is defined as the use of baths (hot or cold springs or natural occurring waters) and other natural remedies (including mud) for healing^(1,3,4). In contrast, current rehabilitation professionals generally define hydrotherapy as a pool therapy program specifically designed for an individual in an attempt to improve neuromuscular and skeletal function. This therapy is conducted and supervised by appropriately qualified personnel, ideally in a purpose-built hydrotherapy pool⁽⁵⁻⁸⁾. The use of hydrotherapy as a rehabilitation tool was first described by Hippocrates (c. 450 - 375 BC) and is now commonly employed by physiotherapists^(5,7,8,44) and occupational therapists⁽⁶⁾.

It has been argued that rehabilitation-related hydrotherapy uses only the physical qualities of water (i.e. the buoyancy, resistance and sometimes its temperature), while the spring waters being used in balneotherapy are bacteriologically pure, have mineral content, and that these minerals have therapeutic potential^(5,8,9,12) in themselves.

Currently, hydrotherapy is applied in many rehabilitative programs. Examples of its use include improving muscular and cardiopulmonary endurance in the elderly⁽⁵⁰⁾, pulmonary rehabilitation in patients with severe asthma^(1,3,4), ventilated patients with Guillain-Barre Syndrome⁽¹⁰⁾, sports injuries⁽¹¹⁾, osteoarthritis and rheumatoid arthritis^(4,9,20,49), various dermatological conditions⁽¹²⁾, Rett syndrome⁽¹³⁾, chronic heart failure^(14,15), reducing spasticity in severe traumatic brain injury patients⁽¹⁶⁾, burns and wound healing^(17-19,45), ankylosing spondylitis⁽²⁰⁾, fibromyalgia^(21,31,48,66), low back pain⁽²²⁾, rehabilitation post anterior cruciate ligament surgery^(23,43), Colles' fracture⁽⁴⁶⁾, and total femur replacement⁽²⁴⁾, pressure ulcer^(25,47), children with complex regional pain syndrome⁽²⁶⁾, rehabilitation of patients with supraspinatus muscle tears⁽²⁷⁾, rehabilitation of patients with spinal muscular atrophy⁽²⁸⁾, rehabilitation of ankle sprains grade I and II⁽²⁹⁾, improving functional mobility in patients with incomplete C-6 spinal cord lesion⁽³⁰⁾, venous stasis/insufficiency⁽³⁵⁻³⁷⁾ including hemorrhoids⁽³⁸⁾, common colds⁽³⁹⁾, urolithiasis⁽⁴⁰⁾, various psychiatric conditions⁽⁴¹⁾ including hysteria⁽⁴²⁾. It is occasionally used during labour and birth^(32,33).

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

The purpose of this review is to investigate the effectiveness of hydrotherapy in musculoskeletal rehabilitation as applied by physiotherapists and occupational therapists.

Levels of evidence are rated according to the hierarchy described in Appendix 1.

II. Material and Methods.

A literature review (up to March 26, 2004) was conducted on multiple databases including OVID, Cochrane Library Database, DARE, NICE, AHRQ, as well as INAHTA and member countries for any review on naturopathic medicine. OVID is a commercial database which encompasses, among others, Biosis (from 1969 to week ten, 2004), Embase (from 1980 to week eight, 2004), MEDLINE (from 1966 to March week 2, 2004) and CINAHL (from 1982 to March week 2, 2004).

The search was limited to human, adults (age ≥ 19) and English language literature (or the availability of English language abstract). The search was done by employing keywords: (hydrotherapy or water pool therapy or pool therapy or aquatic physical therapy) AND (physiotherapy or physical therapy or occupational therapy). The search results were further restricted to high level evidence by employing keywords clinical trials or controlled clinical trials or randomized controlled trials or meta-analysis or review or systematic review or multicase review.

Based on these criteria, 194 articles were extracted. Preliminary analyses were done by reviewing the abstracts of these articles. All articles in English language that did not have abstracts were then retrieved for further evaluation. Research on labour, parturition and on normal subjects were excluded.

III. Results.

III.1. High level evidence on the effectiveness of hydrotherapy.

III.1.1. Hydrotherapy and arthritis.

- In 1997, Verhagen et al⁽⁵¹⁾ published a systematic review (level 1 evidence) on the efficacy of balneotherapy in patients with arthritis. The authors searched Medline and Cochrane library (up to 1995) by employing combination keywords of balneotherapy, hydrotherapy, spa therapy, water therapy, thalassotherapy, arthritis, randomized controlled trials, controlled clinical trials and clinical trials. The search was limited to articles published in English, French, German or Dutch languages. Reference checking and personal communication with experts were also conducted.

There were 37 articles that fulfilled the inclusion criteria. Of these 37, 23 were excluded. Of the 14 articles included in the review, 3 were randomized controlled trials (RCT) within which hydrotherapy was one of the treatment options. These 3 RCTs included patients with osteoarthritis. The results suggested that there was improvement in various different outcome

measurements at the end of treatment. However, the difference between hydrotherapy and other treatment modalities were not statistically significant. Further, the authors concluded that these studies were of medium to low quality.

- In 1999, Van Baar et al⁽⁵¹⁾ conducted a systematic review (level 1 evidence) on the effectiveness of exercise therapy in patients with osteoarthritis of the hip and knee. The authors searched Medline, Embase, CINAHL and Cochrane Trial Register databases (up to September 1997) on any kind of exercise therapy among patients with hip or knee osteoarthritis. There was no restriction with regard to publication language. Seventeen trials were identified. Of these, 10 trials were relevant to the objectives of the review.

Only one trial employed hydrotherapy as one of the main treatments under investigation. This study compared the effectiveness of an aerobic walking program, aerobic hydrotherapy and a non aerobic program directed to range of motion. The results showed that there was no difference between the three exercise groups with regard to flexibility, number of clinically active joints, duration of morning stiffness or grip strength.

- Green et al⁽⁵²⁾ conducted a randomized, single blind, controlled trial (level 1 evidence) among patients with osteoarthritis of the hip attending two hospitals in Leeds, England. Eligible patients were stratified according to sex and age (above or below 70 years). Randomization toward the two treatment groups (home exercise alone and home exercise plus hydrotherapy) was done within the strata and the outcome was presented accordingly (thus, the outcome would be controlled by age and sex already).

Sixty-three patients were eligible to participate and 47 (74.6%) were randomized. Twenty-four patients were randomized into hydrotherapy and 23 patients were randomized to home exercise. The authors described the type and duration of the interventions prescribed. After randomization and prior to the intervention, baseline assessments were done at 0 (at randomization), 3 and 6 weeks. Patients were taught exercises according to the results of the randomization. Those who were randomized into hydrotherapy were asked to attend their treatment twice weekly in a deep pool for a period of 6 weeks, on top of the home exercise that all patients were required to undertake.

Assessments were done at weeks 9, 12 and 18. The outcome measures included active range of motion, muscle strength, analgesic requirement, subjective pain score (10 cm visual analog scale), descriptive pain scale and an overall change score.

The outcomes showed that there was an improvement with regard to both subjective and objective measurements in both groups. There was no significant difference with regard to these measurements between the two treatment groups, independent of age, sex and the radiological level of severity of the osteoarthritis. The authors concluded that, for most patients with osteoarthritis of the hip, a carefully graded and supervised regimen of home exercise was beneficial and there was little benefit in adding hydrotherapy to this regimen.

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

Despite the possibility of running into multiple comparison problems due to the number of outcomes being measured and compared (no designated primary outcome measurement), the study by Green et al⁽⁵²⁾ was well done and documented.

- A single blind, 3-group, randomized controlled trial conducted by Foley et al⁽⁵³⁾ investigated the impact of hydrotherapy on the strength and physical function in patients with osteoarthritis (OA). Hip or knee OA patients were identified from various departments at a general hospital and from community advertisement in South Australia.

Four hundred and twenty-nine potential participants were recruited; 324 of these were excluded mainly due to not meeting the inclusion criteria. One hundred and five participants were randomized into 3 groups; 35 into a hydrotherapy exercise group, 35 into a gym based exercise group and 35 were controls (no exercise at all). The exercise interventions included either 3 water based or 3 gym based exercise sessions a week for six weeks.

The outcome measures included Western Ontario and McMaster Universities OA index (WOMAC), the Adelaide Activities Profile (AAP), The Short Form -12, quadriceps strength and a six-minute walk test. The outcome measurements were done at week 0 and 6.

At baseline, there was no significant difference with regard to the characteristics of the study population in each group. At week 6, in the gym based group, both left and right quadriceps strength was significantly increased as compared to the controls and the right quadriceps was significantly stronger than the hydrotherapy group. The hydrotherapy group demonstrated significantly increased left quadriceps strength but only when compared to controls. The hydrotherapy group was significantly different from controls with regard to distance walked and the physical component of the "SF-12" questionnaire. The gym group was significantly different from the control group for walk speed and self-efficacy satisfaction. With the exception of right quadriceps strength mentioned above, there was no significant difference between gym based and hydrotherapy group in various outcome measurements. There was no difference in drug use between the 3 groups. The authors concluded that functional gains were achieved regardless of the type of exercise programs. It should be noted that there was no significant difference in any outcome between hydrotherapy and the gym based exercise group.

Despite the possibility of running into multiple comparison problems due to the number of outcomes being measured and compared (no designated primary outcome measurement), this study would be assessed as being well done and would rate an evidence level of 2.

- A single blind randomized controlled trial on the effectiveness of structured hydrotherapy program in the management of patients with rheumatoid arthritis (RA) was presented by Hart et al⁽⁵⁴⁾ (abstract only) in 1994.

Forty-six patients with rheumatoid arthritis were randomized into either a group receiving hydrotherapy or one in which hydrotherapy was withheld. Both groups (presumably 23 patients on each group) were similar in terms of their

demographic characteristics and medication usage. Within 3 weeks following randomization, patients in the hydrotherapy group received 15 sessions of supervised pool exercise.

The primary outcome measure in this study was joint range of motion. The secondary outcome measures included subjective pain, joint tenderness, joint swelling, early morning stiffness, grip strength, muscle power, patient function, erythrocyte sedimentation rate, patient's self-assessment and the independent assessor's own assessment of patient's progress. The outcome measurements were done at entry, and at day 7, 14, 21 and 42 after the intervention was initiated.

At 21 and 42 days treatment, there was a clear trend towards improvement in both the hydrotherapy and non-hydrotherapy groups for the primary and all secondary outcome measures. However, there was no significant difference between the 2 groups with regard to any of the outcome measures. The authors concluded that they had been unable to demonstrate the effectiveness of hydrotherapy as one of several interventions in a comprehensive treatment program.

Our reviewers were not able to provide a full assessment on the quality of this trial due to the unavailability of the fully published report. However, the authors presented a comprehensive description of the study in the short published abstract and, on that basis, it was felt to be a well-designed trial.

- Suomi and Koceja⁽⁵⁵⁾ conducted a randomized controlled trial to investigate the effects of the Arthritis Foundation Aquatic Program (AFAP) on postural stability in women with arthritis (abstract only). Twenty-seven females were randomized into an AFAP exercise treatment group (17 females) and control (10 females). The AFAP group participated in a 3 times per week, 6-week aquatic program which was designed to increase strength, range of motion and mobility. The outcome measures in this study were static and dynamic postural stability using a Kistler force platform and custom designed software.

The authors reported that for static postural stability, the AFAP group demonstrated significant decreases in total and lateral sway areas, while the control group did not. For the dynamic condition, the AFAP group demonstrated quicker recovery times. The authors concluded that the AFAP intervention program increased static and dynamic postural stability in females with arthritis.

It was difficult to assess the quality of this trial due to insufficient information provided by the authors in the published abstract. However, the information suggests that the authors' conclusions were not supported by the type of statistical analysis being used in analyzing the outcomes of this study. Hence, this would be classified as a past study and, at best, is of low level evidence.

- In 1996, one hundred and thirty-nine patients were randomized into hydrotherapy, seated immersion, land exercise or progressive relaxation in this study among chronic rheumatoid arthritis patients conducted by Hall et al⁽⁵⁶⁾ (abstract only). Patients attended 30-minute sessions twice weekly for 4 weeks.

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

Physical and psychological measurements were done before and after the intervention, and at 3 months follow-up.

The authors reported that all patients improved physically and emotionally as assessed by Arthritis Impact Measurement Scales 2 questionnaire. Among females (presumably a sub group analysis), hydrotherapy was shown to improve joint tenderness and knee range of motion. At 3 months follow-up, the hydrotherapy group maintained an improvement in emotional and psychological state. The authors concluded that although all patients experienced some benefit, hydrotherapy produced the greatest improvement.

Because of a lack of detailed information on the methodology of the study, it is not possible to evaluate the quality of this trial.

In summary, high level evidence obtained from primary research in hydrotherapy among arthritis patients does not provide conclusive evidence of its effectiveness over other type of exercises prescribed among arthritis patients.

III.1.2. Hydrotherapy and chronic low back pain.

- Maher⁽²²⁾ conducted a review on effective physical treatment modalities for chronic low back pain. This review could not be classified as a systematic one; however, a duplicate search done in the past by the Evidence Based Practice Group on the area of hydrotherapy and chronic low back pain suggested that the author's search was exhaustive in identifying systematic reviews or randomized controlled trial on this topic.

There were two randomized controlled trials appraised in this review. The first, a study by McIlveen and Robertson⁽⁵⁷⁾ found that subjects randomized to a 1 month program of hydrotherapy did not have better outcomes at 1 month follow-up as compared to those randomized to a waiting list. The hydrotherapy program provided no benefit in pain, disability or lumbar range of motion.

The second study by Sjogren et al⁽⁵⁸⁾ compared a hydrotherapy group to a land-based treatment program group. Subjects were assessed at baseline, after a no-treatment run-in period, and then after 1 month of treatment. Sjogren et al⁽⁵⁸⁾ reported that there was no significant difference, for pain, disability and walking speed, between the two types of treatment. Sjogren et al⁽⁵⁸⁾ concluded that both treatments were equally effective. However, Maher⁽²²⁾ argued that to have no between group differences might reflect the fact that both treatments were ineffective. He further argued that the size of the difference within group differences suggested that this was the case (the changes in pain and disability were trivially small and of the same magnitude observed in the no-treatment run-in period). With regard to this argument provided by Maher on the Sjogren et al paper, the conclusions provided by Maher appear sound. In the absence of control (no treatment or standard accepted treatment) group and the small

size of within group differences, it is highly likely that both treatment methods were not effective.

Maher concluded that based on these two trials, there was no evidence that hydrotherapy was effective in treating chronic low back pain.

- Little et al⁽⁵⁹⁾ conducted a systematic review on the effectiveness of various types of exercise being offered for treating chronic low back pain. Due to the inclusion and exclusion criteria employed in this systematic review, Little et al were only able to identify one randomized controlled trial on hydrotherapy and chronic low back pain (McIlveen and Robertson's study⁽⁵⁷⁾). This has been discussed above.

In summary, high level evidence suggests that hydrotherapy is not effective in treating chronic low back pain.

III.1.3. Hydrotherapy and ankylosing spondylitis.

- Dagfinrud and Hagen⁽⁶⁰⁾ conducted a Cochrane systematic review on physiotherapy based interventions for patients with ankylosing spondylitis. The authors searched the Cochrane Trials Register, Medline, Embase, CINAHL and PedRo up to February 2000 by employing the following keywords: (randomized controlled trials or controlled clinical trial) and (spondylitis or ankylosing or spondyloarthropathies or Mb. Bekhterev) and (physiotherapy or physical therapy or exercise or training or hydrotherapy or manual therapy or electrotherapy or education) and (treatment). There were various inclusion and exclusion criteria implemented in this study, including English and Scandinavian languages limitation. Twenty-one studies were identified and 16 of them were excluded. These five studies were included in the review. However, two of these studies were deemed to be follow-up studies and there were, therefore, only 3 studies included in the systematic review, two^(61,62) of which had a component of hydrotherapy as part of the physiotherapy programs.

In the study conducted by Helliwell et al⁽⁶¹⁾, 44 patients diagnosed with ankylosing spondylitis were 'randomized' (by throwing dice) into 3 different interventions, including 3 weeks as an in-hospital patient involved in physiotherapist supervised intensive group exercises that included hydrotherapy, outpatient hydrotherapy and home exercise (for 6 weeks) and home exercise only (for 6 weeks). The authors presented their sample size calculation. However, the sample size calculation was not conducted in order to detect differences between groups (which was what the study needed to answer the objective). The outcomes measured in this study included cervical rotation, chest expansion, lumbar movement (Schober's test), 10 cm visual analog scale for pain and joint stiffness. Outcome variables were collected twice prior to intervention, immediately after intervention, and at 2, 4 and 6 months after intervention. There was a significant difference seen between groups for pain and cervical rotation immediately after the intervention.

However, there was no difference at 6 months follow-up. Further, despite randomization and risk stratification, there were baseline differences between intervention groups. The authors did not take into account the differences in baseline measurements in presenting the outcome analysis.

Hidding et al⁽⁶²⁾ conducted a randomized controlled trial on the effect of adding supervised group physical therapy to unsupervised individualized therapy among ankylosing spondylitis patients. One hundred forty-four patients were randomized (unclear method) into home exercise or home exercise and weekly group physical therapy (which included 1-hour hydrotherapy in each session). The outcome measures included spinal mobility, maximum work capacity, Sickness Impact Profile, Health Assessment Questionnaire for Spondyloarthropathies and Functional Index (the primary outcome was not defined). Outcomes were measured at baseline and at 3, 6 and 9 months intervention. The authors reported that weekly physical therapy group had significantly better outcomes (spinal mobility, maximum work capacity and global assessment) compared to the home exercise group. It should be noted that a quality assessment of this paper would rate this research as **poor**.

- Van Tubergen et al⁽⁶³⁾ conducted a randomized controlled trial on ankylosing spondylitis and spa-exercise therapy. The components of spa-exercise therapy included physical exercises, walking, postural correction therapy by lying supine on bed, hydrotherapy, sports, bathing and thermal visits. In total, 120 patients were randomized into 3 groups of 40 patients each. Group 1 received 3 weeks of spa therapy at a spa resort in Austria, group 2 received 3 weeks spa therapy in the Netherlands and group 3 stayed home and continued standard treatment. Hydrotherapy was a component in each of the spa therapy groups.

Even though the authors claimed that the spa-exercise groups were better than controls at 16 and 28 weeks follow-up, the effect of hydrotherapy component alone in this primary study could not be measured separately. The study design precluded this measurement. It also should be noted that this study was of better quality than the two previous studies among ankylosing spondylitis patients; however, no direct comment on 'hydrotherapy' can be obtained from this research.

In summary, there was no significant positive evidence on the effectiveness of hydrotherapy treatment (alone or as a component of physical therapy program) among ankylosing spondylitis patients.

III.1.4. Hydrotherapy and rehabilitation of patients with anterior cruciate ligament disruption.

Thomson et al⁽²³⁾ conducted a Cochrane systematic review on the effectiveness of physiotherapist-led programs and interventions for rehabilitation of anterior cruciate ligament (ACL), medial collateral ligament

(MCL) and meniscal injuries (M) of the knee in adults. The authors conducted searches on Cochrane Musculoskeletal Injuries Group specialized database (up to June 2001), Medline (1966 to August 1999), Embase (1987 to February 1997), CINAHL (1982 to April 1999), Current Contents (up to March 1999), reference lists of relevant articles and consulted their colleagues. The following words were employed: anterior cruciate ligament or tibial menisci or posterior cruciate ligament or patellar ligament or medial collateral ligament or soft tissue injuries or sprains or strains or athletic injuries or knee injuries or knee ligament. All subheadings within each keyword were explored. Various inclusion and exclusion criteria were also implemented in this systematic review. The authors found 31 trials, involving 1545 mainly young and male patients. Only two^(64,65) of these 31 trials involved the application of hydrotherapy vs. land-based rehabilitation program among patients.

A review of these two trials notes that McClintock et al⁽⁶⁴⁾ randomized (method not clear) 20 post ACL reconstructive surgery patients into two rehabilitation programs: 10 days 'standard' home program followed by 7 hydrotherapy sessions and 10 days 'standard' home program followed by 7 land based therapy sessions. The hydrotherapy based and land-based programs were not similar or equivalent. Both rehabilitation programs took 28 days. Outcome, i.e. knee ROM, was measured blinded at pre-operation, 10 days post operation and pre and post therapy sessions (7 measurements in all up to 28 days follow-up). There was no further outcome data available as it was only available as a conference proceedings abstract. However, the authors did report that patients in the hydrotherapy program demonstrated significantly greater gain in mean flexion and range of motion at four weeks. The authors also reported that hydrotherapy based patients showed a significantly faster rate of return to pre-operative values of knee extension.

In the second paper, Tovin et al⁽⁶⁵⁾ randomized (by coin toss and alternation in pairs) 20 patients post arthroscopic ACL reconstructive surgery into two equivalent rehabilitation program groups. One was land-based and one water-based. Ten patients were randomized into each group. In the first week, both groups attended the same standard home exercise program including partial weight bearing. From week 2 to 8 post-operatively, patients were then assigned to a series of equivalent rehabilitation programs that were performed in the same sequence, one group in land and the other group in water-based therapy. Outcome measures included joint laxity, thigh girth, passive range of motion (at 2 weekly intervals) and muscle strength (at week 8 only). These outcome measures were done by one, blinded, assessor). Subjective assessment of knee function (as measured by Lysholm scale) was done at week 8. At week 8, the mean Lysholm score was significantly higher among the hydrotherapy group of patients compared to the land-based rehabilitation patients. At week 8, there was no significant difference between the two groups with regard to muscle strength, passive range of motion, girth measurement above mid patella level. Less joint effusion was also noted among the hydrotherapy group (not significant). The authors concluded that, although hydrotherapy based exercise might not be as effective as exercise on

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

land for regaining maximum muscle performance, hydrotherapy might minimize the amount of joint effusion and lead to greater self report of functional improvement in patients with intra-articular ACL reconstruction.

In summary, there was evidence that post op hydrotherapy may be more effective than a land-based rehabilitation program for those patients undergoing ACL reconstructive surgery.

III.1.5. Hydrotherapy and pressure ulcer healing.

Burke et al⁽²⁵⁾ conducted a randomized trial (randomization method unclear) on the effects of hydrotherapy on pressure ulcer healing among hospital inpatients with grade III-IV pressure ulcers. A total of 42 wounds (from 18 patients) were randomized into one group (24 wounds), in which each wound was treated for 20 minutes of whirlpool therapy every day for at least 2 weeks and 18 wounds were assigned into non-whirlpool treatment group. Each wound, regardless of the randomization group, was also treated with 'standard' care for pressure ulcer treatment. The wounds were viewed and classified on admission to the study, and then once per week by a study physician who was blinded to the group assignment. At the end of the study period (duration of the study was not reported), the authors reported that the whirlpool group improved at a significantly faster rate than non whirlpool group.

It should be noted that this study did not provide clear outcome criteria and there was no information on the baseline characteristics of the study population reported. The statistical methods employed in the data analysis were felt to be inappropriate and the outcome measures were not adjusted to potential confounders within the trial.

In summary, there was no high level evidence on the effectiveness of the addition of whirlpool sessions in treating grade III-IV pressure ulcers.

III.1.6. Hydrotherapy and fibromyalgia.

In 2000, Mannerkorpi et al⁽⁶⁶⁾ conducted a randomized controlled trial among 58 patients diagnosed with fibromyalgia in an attempt to investigate the effects of a program of 6 months of pool exercise therapy combined with 6 education sessions. Sixty-nine women diagnosed with fibromyalgia (according to the American College of Rheumatology criteria) were recruited from primary health care and rheumatology clinics in Sweden. Inclusion and exclusion criteria were explained. Thirty-seven patients were randomized into a treatment group and 32 patients were controlled. 'Randomization' was done using sequential

allocation according to age and symptom duration. Nine patients in the treatment group and 2 in the control group dropped out after 'randomization' (and subsequent data was not analyzed according to the intention to treat principle). The patients were instructed to continue their baseline medical treatment. It was noted that the control group had a significantly higher baseline consumption of non-steroidal anti-inflammatory drugs when compared to the treatment group.

Patients in the treatment group received an exercise program in a temperate pool, supervised by a physiotherapist, once a week for 6 months. The education program consisted of six 1-hour sessions led by one physiotherapist and was based on active participation of the patients. The aim of the program was to introduce strategies to cope with fibromyalgia symptoms and to encourage physical activity.

Primary outcome measures in this study included the Fibromyalgia Impact Questionnaire (FIQ) and the 6 minutes walk test. Secondary outcome measures included the Short Form 36 (SF-36), The Swedish version of the Multidimensional Pain Inventory (MPI), The Arthritis Self Efficacy Scale (ASES), The Arthritis Impact Measurement Scale, The Quality of Life Questionnaire and various tests of functional limitations which were undertaken by one physiotherapist blinded to patient group allocation. The authors did not provide a sample size calculation. At baseline, patients in the treatment group showed significantly higher scores on general health and mental health in the SF-36, and higher levels of social support on the MPI. Also found were higher scores for self-efficacy for pain and symptoms on the ASES, and a lower degree of depression on the FIQ than the control group. The authors noted that adjustments for these differences were done in a subsequent analysis and did not change the results of between group analyses. Even though adjustments were made, the application of Mantel's technique of pooling applied to Fisher's permutation test, as mentioned in the statistical methods, is felt to not be the appropriate method to analyze such differences. Further, given the number of statistical tests being performed and reported, the authors did not attempt to adjust the level of p-value (set at 0.05) to take into account the multiple comparisons being done.

At 6 months, significant differences between groups were found for the FIQ total score, the 6 minutes walk test, physical function, grip strength, pain severity, social functioning, psychological distress and quality of life. The treatment group had significantly better performance in these variables compared to controls. The authors concluded that the results of the 6-month exercise program in a temperate pool combined with education improved many parameters of patients with fibromyalgia.

In summary, the only 'high level' study on the effectiveness of hydrotherapy in treating fibromyalgia did not provide sufficient evidence to suggest it was efficacious. The study conducted by Mannerkorpi et al⁽⁶⁶⁾ should be seen at best, as a case control study (instead of a randomized controlled trial); thus, it would be classified as low level evidence. Further, the authors did not employ proper statistical methods in analyzing and presenting the data.

III.2. Interesting application of hydrotherapy among children diagnosed with Complex Regional Pain Syndrome (CRPS) (Evidence level 3-4).

Sherry et al⁽²⁶⁾ followed 103 children (49 were followed for more than 2 years) who were diagnosed with CRPS and had been treated in an extensive exercise program which included 4 hours of aerobic, 1 to 2 hours of hydrotherapy and desensitization, everyday, without any other medications or modalities being used. The extensive exercise program was performed, on average, for 14 days.

Outcome measures included pain, presence of physical dysfunction, recurrent episodes of CRPS and other disproportional musculoskeletal pain measures. Ninety-five children (92%) initially became symptom-free. Of those followed for more than 2 years, 43 (88%) were symptom free (15 of these patients had one reoccurrence), 5 (10%) were fully functional but had some continued pain and 1 (2%) had functional limitations. The median time of reoccurrence was 2 months; 79% of the reoccurrences occurring during the first 6 months of treatment.

III.3. Complications due to hydrotherapy.

Several studies reported complications, including legionella infections, burns, folliculitis and hypersensitivity pneumonitis, which were related to hydrotherapy.

Marrie et al⁽⁶⁷⁾ reported the isolation of legionella pneumophila from a physiotherapy pool in Halifax. Among physiotherapists who used the pool during the contamination, 16 (75%) had an antibody titer < 1:64 and 1 (5%) had a titer of 1:256. Further, the authors reported the isolation of Legionella pneumophila from whirlpool spa by the Vermont department of health in a 1998 study. The authors also reported two outbreaks of Pontiac fever associated with whirlpool use.

Hanzlick et al⁽⁶⁸⁾ reported burns of the torso and extremities as the result of whirlpool treatment with overheated water in an elderly man. The elderly man was in a nursing home and in long term care due to post stroke immobility and paresis, and the hydrotherapy was part of the treatment he received. The elderly man subsequently died due to the burns and wound sepsis.

Hwang et al⁽⁶⁹⁾ reported a case of a paraplegic patient who was receiving hydrotherapy for treatment of his malleolar ulcer. This 39 year old paraplegic

patient lacked sensation below the T-12 dermatome. In one of the hydrotherapy sessions, he sustained immersion scald burns that ultimately necessitated below knee amputations of both legs.

Schlech et al⁽⁷⁰⁾ reported an outbreak of hospital-acquired *Pseudomonas aeruginosa* folliculitis among hospital staff and patients using a swimming pool in a newly constructed physiotherapy unit. *Pseudomonas* folliculitis developed in 21% of outpatients and 33% of inpatients who had used the facility. *Pseudomonas* infection of a surgical wound also developed in one of four inpatients with wounds, who received treatment in that pool.

Aksamit et al⁽⁷¹⁾ reported 9 cases of hypersensitivity pneumonitis in association with hot tub exposure. Subsequent testing showed that the *Mycobacterium avium* complex (MAC) organisms isolated from these patients matched those isolated from the hot tub water. The authors compared these 9 cases with 32 similar cases reported in the literature.

It should be noted that this review did not conduct an exhaustive search on the complications associated with hydrotherapy. The above are for illustration purposes only and one meant to give the reader a sense that such treatment is not always innocuous.

IV. Summary.

1. The application of water to treat disease has been used throughout history. It is known that Hippocrates (460 – 375 BC) used hot and cold water in the treatment of multiple disease states.
At present, hydrotherapy is applied to treat a myriad of diseases, including musculoskeletal problems. The majority of the evidence on the effectiveness of hydrotherapy to treat the described disease states and ‘conditions’ comes from small case series/reports and subsequent low level evidence (Level 4¹).
2. The higher level evidence that was reviewed does not suggest hydrotherapy is effective in treating osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, chronic low back pain, fibromyalgia or pressure ulcers.
There were two papers that did suggest that post ACL reconstructive surgery patients may have better outcomes than those undertaking land based exercises alone.
3. The application of hydrotherapy is not always without risk. There are reports in the literature regarding legionella infections, burn, folliculitis and hypersensitivity pneumonitis which were directly related to the hydrotherapy.

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

Appendix 1

Workers' Compensation Board of B.C. – Evidence-Based Practice Group. Quality of evidence ^(adapted from a,b,c,d)

Quality of Published Evidence

1	Evidence from at least 1 properly randomized controlled trial (RCT) or systematic reviews of RCTs.
2	Evidence from well-designed controlled trials without randomization or systematic reviews of observational studies.
3	Evidence from well-designed cohort or case-control analytic studies, preferably from more than 1 centre or research group.
4	Evidence from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments could also be included here.
5	Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees.

Reference

- ^a Canadian Task Force on the Periodic Health Examination: The periodic health examination. CMAJ. 1979;121:1193-1254.
- ^b Houston TP, Elster AB, Davis RM et al. The US Preventive Services Task Force Guide to Clinical Preventive Services, Second Edition. MA Council on Scientific Affairs. American Journal of Preventive Medicine. May 1998;14(4):374-376.
- ^c Scottish Intercollegiate Guidelines Network (2001). SIGN 50: a guideline developers' handbook. SIGN. Edinburgh.
- ^d Canadian Task Force on Preventive Health Care. New grades for recommendations from the Canadian Task Force on Preventive Health Care. CMAJ. Aug 5, 2003;169(3):207-208.

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

References.

1. Beamon S and Falkenbach A. Hydrotherapy for asthma (protocol). In: The Cochrane Library, Issue 1, 2004. Chichester, UK: John Wiley and Sons, Ltd.
2. Karel R. Aquatic physical therapy: Civilian and military perspectives. *PT Magazine*. January 2003; 42:42-48.
3. Strauss-Blasche G, Ekmekcioglu C, Vacariu G et al. Contribution of individual spa therapies in the treatment of chronic pain. *Clinical Journal of Pain*. 2002;18:302-309.
4. March LM, Stenmark J. Managing arthritis. Non-pharmacological approaches to managing arthritis. *Medical Journal of Australia*. 19 Nov 2001;175(SUPPL.):S102-S107.
5. ..Australian Physiotherapy Association: Clinical standards for hydrotherapy. *Australian Journal of Physiotherapy*. 1990;36(3):207-210.
6. Brown CA. Occupational therapists' beliefs regarding treatment options for people with chronic pain. *British Journal of Occupational Therapy*. Sept. 2002;65(9):398-404.
7. Goldby LJ and Scott DL. The way forward for hydrotherapy. *British Journal of Rheumatology*. 1993;32(9):771-773.
8. Bender T, Balint PV and Balint GP. A brief history of spa therapy. *Annals of the Rheumatic Diseases*. 2002; 61(10):949-950.
9. Jones G, Francis HW, Grimmer KA et al. Ancillary services in rheumatology. *Medical Journal of Australia*. 1997;166(8):434-439.
10. Taylor S. The ventilated patient undergoing hydrotherapy: a case study. *Australian Critical Care*. Aug 2003; 16(3):111-115.
11. Prins J and Cutner D. Aquatic sports injury rehabilitation. Aquatic therapy in the rehabilitation of athletic injuries. *Clinics in Sports Medicine*. April 1999;18(2):447-461.
12. Matz H, Orion E, Wolf R. Balneotherapy in dermatology. *Dermatologic Therapy*. 2003;16:132-140.
13. Leonard H, Fyfe S, Leonard S and Msall M. Functional status, medical impairments and rehabilitation resources in 84 females with Rett syndrome: A snapshot across the world from the parental perspective. *Disability and Rehabilitation*. 2001;23(3-4):107-117.
14. Michalsen A, Ludtke R, Buhning M et al. Thermal hydrotherapy improves quality of life and hemodynamic function in patients with chronic heart failure. *American Heart Journal*. Oct 2003;146(4):E11.
15. Cider A, Schaufelberger M, Sunnerhagen KS et al. Hydrotherapy - a new approach to improve function in the older patient with chronic heart failure. *European Journal of Heart Failure*. Aug 2003;5(4):527-535.
16. Keren O, Reznik J, Groswasser Z. Combined motor disturbances following severe traumatic brain injury: an integrative long term treatment approach. *Brain Injury*. Jul 2001;15(7):633-638.

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

17. Acikel C, Ulkur E and Guler MM. Prolonged intermittent hydrotherapy and early tangential excision in the treatment of an extensive strong alkali burn. *Burns*. May 2001; 27(3): 293-296.
18. Meeker BJ. Whirlpool therapy on postoperative pain and surgical wound healing: an exploration. *Patient Education and Counseling*. 1998;33:39-48.
19. Hess CL, Howard MA, Attinger CE. A review of mechanical adjuncts in wound healing: hydrotherapy, ultrasound, negative pressure therapy, hyperbaric oxygen and electrostimulation. *Annals of Plastic Surgery*. 2003;51:210-218.
20. van Tubergen A and Hidding A. Spa and exercise treatment in ankylosing spondylitis: fact or fancy? *Best Practice and Research. Clinical Rheumatology*. 2002;16(4):653-666.
21. Mannerkorpi K, Ahlmén M, Ekdahl C. Six- and 24-month follow-up of pool exercise therapy and education for patients with fibromyalgia. *Scandinavian Journal of Rheumatology*. 2002;31:306-310.
22. Maher CG. Effective physical treatment for chronic low back pain. *Orthopedics Clinics of North America*. January 2004;35(1):57-64.
23. Thomson LC, Handoll HHG, Cunningham A and Shaw PC. Physiotherapist-led programmes and interventions for rehabilitation of anterior cruciate ligament, medial collateral ligament and meniscal injuries of the knee in adults (Cochrane Review). In: *The Cochrane Library*, Issue 1, 2004. Chichester, UK: John Wiley and Sons, Ltd.
24. Katrak P, O'Connor B, Woodgate I. Rehabilitation after total femur replacement: a report of 2 cases. *Archives of Physical Medicine and Rehabilitation*. July 2003; 84: 1080-1084.
25. Burke DT, Ho CHK, Saucier M, Stewart G. Effects of hydrotherapy on pressure ulcer healing. *American Journal of Physical Medicine and Rehabilitation*. Sept-Oct 1998;77(5):394-398.
26. Sherry D, Wallace C, Kelley C et al. Short- and long-term outcomes of children with complex regional pain syndrome type 1 treated with exercise therapy. *Clinical Journal of Pain*. Sept 1999; 15(3): 218-223.
27. Palmer SL. Aquatic physical therapy case report: rehabilitation of a patient with a supraspinatus tear by aquatic therapeutic home exercises. *Journal of Aquatic Physical Therapy*. Nov 1998;6(2):24-27.
28. Cunha MC, Oliviera AS, Labronici RH et al. Spinal muscular atrophy type II (intermediary) and III (Kugelberg-Welander). Evolution of 50 patients with physiotherapy and hydrotherapy in a swimming pool. *Arquivos de Neuro-Psiquiatria*. Sept 1996;54(3):402-406.
29. Geigle P, Dadonna K, Finken K et al. The effects of a supplemental aquatic physical therapy program on balance and girth for NCAA division III athletes with a grade I or II lateral ankle sprain. *Journal of Aquatic Physical Therapy*. Fall 2001; 9(1): 13-20.
30. Stowell T, Fuller R, Fulk G. An aquatic and land-based physical therapy intervention to improve functional mobility for an individual after an incomplete C6 spinal cord lesion. *Journal of Aquatic Physical Therapy*. Fall 2001; 9(1): 27-32.

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

31. Kendall SA, Ekselius L, Gerdle B et al. Feldenkrais intervention in fibromyalgia patients: a pilot study. *Journal of Musculoskeletal Pain*. 2001; 9(4): 25-35.
32. Zick SM, Raisler J, Warber SL. Pregnancy. *Clinics in Family Practice*. 2002;4(4):1005-1028.
33. Tanizaki Y, Komagoe H, Sudo M et al. Swimming training in a hot spring pool as therapy for steroid dependent asthma. *Japanese Journal of Allergology*. 1984;33(7):389-395.
34. Thorp JA, Murphy-Dellos L. Epidural and other labour analgesic methods. *Drugs of Today*. 1998;34(6):525-536.
35. Schlenzka K. Treatment by natural remedies in phlebology. *Phlebologie*. 2003;32(3):60-64.
36. Mancini S, Piccinetti A, Nappi G et al. Clinical, functional and quality of life changes after balneokinesis with sulphurous water in patients with varicose veins. *Vasa*. Febr 2003;32(1):26-30.
37. Lacroix P, Aboyans V, Cornu E. Water cures in venous insufficiency. *Revue du Praticien*. Jun 2000;50(11):1212-1215.
38. MacKay DJ. Hemorrhoids and varicose veins: a review of treatment options. *Alternative Medicine Review*. 2001;6(2):126-140.
39. Ernst E. Is protection against common colds possible?. *Fortschritte Der Medizin*. 1990;108(31).
40. De Luca S, Nappi G, Menconi Orsini A. 'Project Naiad': lithiasic pathology of urinary tracts and water therapy with oligomineral waters. *Medicina Clinica e Termale*. 2001;13(47):197-206.
41. Braslow JT. Punishment or therapy: patients, doctors, and somatic remedies in the early twentieth century. *Psychiatric Clinics of North America*. 1994;17(3):493-513.
42. Dubois O. From hydrotherapy to other body mediation therapies in the management of hysteria. *Neuro-Psy News*. 2003;2(1):20-23.
43. Kuhne C, Zirkel A. Accelerated rehabilitation following patellar tendon autograft anterior cruciate ligament reconstruction using the aqua-jogging protocol: a primary study. *Sports, Exercise and Injury*. 1996;2(1):15-23.
44. Toomey R, Grief-Schwartz R. Extent of whirlpool use in Canadian physiotherapy department: a survey. *Physiotherapy Canada*. 1986;38(5):277-278.
45. Gogia PP, Hurt BS and Zirn TT. Wound management with whirlpool and infrared cold laser treatment. A clinical report. *Physical Therapy*. Aug 1988;68(8):1239-1242.
46. Toomey R, Grief-Schwartz R, Piper MC. Clinical evaluation of the effects of whirlpool on patients with Colles' fractures. *Physiotherapy Canada*. 1986;38(5):280-284.
47. McCulloch JM Jr, Kemper CC. Vacuum-compression therapy for the treatment of an ischemic ulcer. *Physical Therapy*. Mar 1993;73(3):165-169.
48. Gunther V, Mur E, Kinigadner U, Miller C. Fibromyalgia - the effect of relaxation and hydrogalvanic bath therapy on the subjective pain experience. *Clinical Rheumatology*. Dec 1994;13(4):573-578.
49. Clarke AK. Effectiveness of rehabilitation in arthritis. *Clinical Rehabilitation*. 1999; 13(Suppl 1):51-62.

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

50. Satterfield MJ, Yasumara K, Goodman G. Impact of an engineered physical therapy program for the elderly. *International Journal of Rehabilitation Research*. 1984;7(2):151-162.
51. van Baar ME, Assendelft WJJ, Dekker J et al. Effectiveness of exercise therapy in patients with osteoarthritis of the hip or knee. *Arthritis and Rheumatism*. July 1999; 42(7): 1361-1369.
52. Green J, McKenna F, Redfern EJ, Chamberlain MA. Home exercises are as effective as outpatient hydrotherapy for osteoarthritis of the hip. *British Journal of Rheumatology*. 1993;32:812-815.
53. Foley A, Halbert J, Hewitt T and Crotty M. Does hydrotherapy improve strength and physical function in patients with osteoarthritis - a randomized controlled trial comparing a gym based and a hydrotherapy based strengthening programme. *Annals of Rheumatic Disease*. 2003;62:1162-1167.
54. Hart LE, Goldsmith CH, Churchill EM, Tugwell P. A randomized controlled trial to assess hydrotherapy in the management of patients with rheumatoid arthritis. *ACR Poster Session. Miscellaneous Rheumatologic Disorders. Arthritis and Rheumatism*. 1994;37(9 Suppl):S416.
55. Suomi R, Koceja DM. Effects of the Arthritis Foundation Aquatic Program (AFAP) on postural stability in women with arthritis. Annual meeting abstract. A-17 Poster chronic disease and disability. *Medicine and Science in Sports and Exercise*. May 1996;28(5 Suppl):8.
56. Hall J, Skevington SM, Maddison PJ, Chapman K. A randomized and controlled trial of hydrotherapy in rheumatoid arthritis. *Arthritis Care and Research*. Jun 1996;9(3):206-215.
57. McIlveen B, Robertson VJ. A randomized controlled study of the outcome of hydrotherapy for subjects with low back or back and leg pain. *Physiotherapy*. Jan 1998;84(1):17-26.
58. Sjogren T, Long N, Storay I, Smith J. Group hydrotherapy versus group land-based treatment for chronic low back pain. *Physiotherapy Research International*. 1997;2(4):212-222.
59. Liddle SD, Baxter GD, Gracey JH. Exercise and chronic low back pain: what works? *Pain*. 2004;107:176-190.
60. Dagfinrud H, Hagen K. Physiotherapy interventions for ankylosing spondylitis (Cochrane Review). In: *The Cochrane Library, Issue 1, 2004*. Chichester, UK: John Wiley and Sons, Ltd.
61. Helliwell PS, Abbott CA, Chamberlain MA. A randomized trial of three different physiotherapy regimes in ankylosing spondylitis. *Physiotherapy*. 1996;82(2):85-89.
62. Hidding A, van der Linden S, Boers M et al. Is group physical therapy superior to individualized therapy in ankylosing spondylitis? A randomized controlled trial. *Arthritis Care and Research*. Sept 1993;6(3):117-125.
63. van Tubergen A, Landewe R, van der Heijde D et al. Combined spa-exercise therapy is effective in patients with ankylosing spondylitis: a randomized controlled trial. *Arthritis and Rheumatism*. Oct 2001;45(5):430-438.
64. McClintock JH, Kirkley A, Fowler PJ. Prospective randomized controlled trial of standard physiotherapy versus aquatic therapy for early rehabilitation of the ACL

Hydrotherapy. Review on the effectiveness of its application in physiotherapy and occupational therapy.

- reconstructed knee. *Journal of Bone and Joint Surgery. British volume.* 1995;77 Suppl III:313-314.
65. Tovin BJ, Wolf SL, Greenfield BH et al. Comparison of the effects of exercise in water and on land on the rehabilitation of patients with intra-articular anterior cruciate ligament reconstructions. *Physical Therapy.* 1994;74:710-719.
 66. Mannerkorpi K, Ahlmén M, Ekdahl C. Pool exercise combined with an education program for patients with fibromyalgia syndrome. A prospective, randomized study. *Journal of Rheumatology.* Oct 2000;27(10):2473-2481.
 67. Marrie TJ, Gass R, Sumarah R, Yates L. *Legionella pneumophila* in a physiotherapy pool. *European Journal of Clinical Microbiology.* 1987; 6(2):212-213.
 68. Hanzlick R. Case of the month. Complications of therapy, nursing homes and the elderly. *Archives of Internal Medicine.* April 13 1998;158:695-696.
 69. Hwang JCF, Himmel HN, Edlich RF. Bilateral amputations following hydrotherapy tank burns in a paraplegic patient. *Burns.* 1995;21(1):70-71.
 70. Schlech EF, Simonsen N, Sumarah R, Martin RS. Nosocomial outbreak of *Pseudomonas aeruginosa* folliculitis associated with physiotherapy pool. *Canadian Medical Association Journal.* April 15 1986;134(8):909-913.
 71. Aksamit TR. Hot tub lung: infection, inflammation, or both?. *Seminars in Respiratory Infections.* Mar 2003;18(1):33-39.