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REPORT

*HEAT TREATMENT
FOR
DEGENERATIVE
CHANGES IN
SKELETAL SYSTEM*

HEALTH TECHNOLOGY ASSESSMENT UNIT
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MOH/P/PAK/58.03(TR)

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EXECUTIVE SUMMARY

Osteoarthritis and degenerative musculo-skeletal disease are among the most common diseases encountered in clinical practice. Rheumatoid arthritis and its variants is similarly a common disease affecting a large population. These conditions cause pain and disability especially among the elderly. Pain relief is the most important goal of therapy. Pharmaco-therapy is not without its difficulties or adverse effects in the elderly population. Therefore non-pharmacologic treatment like heat or cold therapy and physical exercise are frequently being used. Heat is used either as the primary therapy or adjunct therapy to prevent or minimize the consequences of inflammation in the above conditions. The heat therapy modalities that are currently available in clinical practice are: hot packs, infrared, wax bath, ultrasound, short wave diathermy, microwave, laser, corona discharge (Sonotron) and capsaicin.

The objective of this assessment is to determine the safety, effectiveness and cost implications of heat treatment for degenerative changes of skeletal system.

There is insufficient evidence to support the effectiveness and safety of microwave therapy, short wave diathermy, interferential therapy, infrared therapy, and hot-packs therapy for the treatment of musculo-skeletal degenerative disease. In addition, there is inconclusive evidence on the effectiveness of ultrasound, wax bath, laser, and corona discharge (Sonotron) for the treatment for musculo-skeletal degenerative disease. However, capsaicin has been found to be safe and useful for treating osteoarthritis, but there is insufficient evidence of its effectiveness in treating rheumatoid arthritis. In a survey of the local situation, it was found that there is variation in selection of the modality of treatment by surgeons and physiotherapists for some common conditions including musculo-skeletal degenerative disease.

It is recommended that treatment for common conditions requiring heat treatment be standardised. More studies need to be carried out at the local level to examine the effectiveness of some of these modalities.

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1. INTRODUCTION

Osteoarthritis and degenerative musculo-skeletal disease are among the most common forms of disease encountered in clinical practice. Rheumatoid arthritis and its variants is similarly a common disease affecting a large population. These conditions cause pain and disability especially among the elderly. Pain relief is the most important goal of therapy. Pharmaco-therapy is not without its difficulties or adverse effects in the elderly population. Therefore non-pharmacologic treatment like heat or cold therapy and physical exercise are frequently being used. Heat is used either as the primary therapy or adjunct therapy to prevent or minimize the consequences of inflammation in the above conditions (Finsen *et al*, 1999). The heat therapy modalities that are currently available in clinical practice are shown in Table 1.

Table 1: Heat Therapy Modalities

Hot Packs
Infrared
Wax bath
Ultrasound
Short wave diathermy
Microwave hyperthermia
Laser
Sonotron
Capsaicin

2. TECHNICAL FEATURES

The technical features of the various modalities are as described below.

2.1 Microwave Hyperthermia

Microwave refers to electromagnetic radiation that lies between radio-waves and infrared, with wavelengths between 1 m and 1 cm, hence from 300MHz to 30 GHz in frequency. There are three frequencies used in Medicine – 2 450 MHz, 915 MHz and 433.9 MHz. The heating effect of microwave has become well known with the development of microwave ovens, while microwaves are also used in and use in communications, telephones, tracking ships, aircraft, rockets and satellites as radar.

Microwave radiation, like other electromagnetic radiation, is reflected and refracted at interfaces, and has varying degrees of absorption or penetration depending on the nature of the materials. It also exhibits rectilinear propagation. While microwaves penetrate issues to some extent, they are

strongly absorbed by water, and hence for highly vascular tissues like muscles, microwave is an effective method of tissue heating.

2.2 Short-Wave Diathermy

In short-wave diathermy (SWD), high frequency current is generated by an oscillator circuit that allows electrons to oscillate at a frequency of 27.12 MHz. The part to be treated is included in a separate circuit, either between two electrodes or close to an induction coil, which is tuned to have the same natural frequency as the oscillator circuit. Thus, high frequency electrical energy is transferred to the tissues.

SWD provides two forms of heating – deep heating called conversion or conversive heating as a result of heat passing through the tissues, and superficial heating where heat from outside is transferred to the skin through conduction, convection or radiation. Consequently, SWD can be used to treat both deep and superficial lesions. Large areas can be treated, and it has been said to be useful for soft-tissue injuries, degenerative and inflammatory arthropathies, slow healing wounds, sinusitis and conditions related to deep-seated pelvic structures.

2.3 Interferential Therapy

Interferential therapy uses two medium frequency currents of slightly differing frequencies to interfere each other, thus causing a new resultant current. The resultant amplitude at any given point is the sum of the two individual current amplitudes, so that they will augment each other where two peaks or two troughs coincide; but they cancel out each other where a peak and trough coincide.

Interferential currents have been thought to relieve pain by activating the pain gate mechanism due to stimulation of large diameter, low threshold nerve fibers with high-beat frequencies of around 100 Hz. It could also be that low frequency waves (10 - 25Hz) cause activation of A delta and C fibers resulting in enkephalin and endorphin release. Another possibility is that stimulation by high frequencies of above 50 Hz, may lead to temporary physiological block of finely myelinated and non-myelinated nociceptive fibers. It has also been postulated that mild muscle contraction and possibly stimulation of autonomic nerves, may cause increased fluid flow and fluid exchange that may help to remove chemical irritants affecting pain nerve endings and reduce local tissue pressure. Finally, pain relief could be due to a placebo effect, which occurs in all treatments, especially since the interferential machines are technically impressive and produce a distinct, and somewhat unusual but unpleasant sensation.

2.4 Ultrasound

Ultrasound refers to high frequency sound waves beyond the range of human hearing. The frequencies typically used in physiotherapy range from 0.75 to 3 MHz.. Absorption of ultrasound in tissues causes an oscillation of particles about their mean position, or sonic energy, that is converted into heat energy, proportional to the intensity of the ultrasound.

2.5 Infrared

Phototherapy in the management of analgesia and wound healing was introduced with the advent of infrared (830nm), Gallium Aluminum Arsenide and the red (633nm) Helium Neon Low Power Laser. While the exact mechanism of pain relief is not completely understood, it seems to be related to an anti-inflammatory effect of phototherapy. A histochemical study on the application of infra-red light found a marked increase of prostaglandin I₂ with consequent

inhibition of platelet aggregation and vasodilatation. This improvement of local circulation leads to reduction in edema and better oxygenation of tissues and this may result in reduction of pain (Kudoh *et.al*, 1989). Apart from this, phototherapy seems to produce an increase in Na-k-ATPase and this may contribute to pain attenuation, since it has been shown that a lack of Na-k-ATPase activity seems to increase nociceptive impulse transmission.

2.6 Hot Packs

There are said to be three techniques for the delivery of whole-body hyperthermia, the simplest of which is direct contact between the skin and surrounding fluid like water, wax, air or other fluid medium such as mud. Consequently, heat is transferred from the surrounding fluid to the body surface. In addition, blood vessels in the skin surface will transfer the heat to the perfusing blood, which uniformly distributes the heat throughout the body. Besides this, the other two techniques are irradiation with nonionizing radiation to deliver heat, and extra-corporeal perfusion (Milligan AJ, 1984).

2.7 Wax Bath

In hot wax bath therapy paraffin wax is heated to 50°C in a special container (Yung P et al., 1986). The patient's hand is coated by repeatedly dipping in the hot wax bath. The limb is then wrapped in a terry towel (or placed in a polythene bag first) to provide insulation, to transfer the energy released from the latent energy of solidification of the wax to the underlying tissues of the hand (Bromley et.al, 1994).

2.8 Laser Therapy

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Light is emitted into a particular medium, which energizes electrons. The energy of the light is increased and focused in a beam which can be tunneled along fiberoptic fibers or projected as a beam through the end of the instrument. The medium through which the light passes is commonly gaseous, such as Argon, Helium, Neon, CO₂, but may be crystalline, such as Neodymium Yttrium Aluminum Garnet (Nd-YAG). The beam produced is monochromatic, coherent and collimated. Its wavelength is determined by the laser medium and the degree of absorption of the beam by tissue is dependent on the wavelength. Low level lasers are used in the treatment of degenerative musculo-skeletal diseases. Despite the increasing popularity and use of the laser therapy in the degenerative musculo-skeletal disease, the mechanism of action remains unknown. The low power outputs used in these lasers do not produce appreciable temperature changes in the treated tissue. Any benefit is attributed to a non-thermal process resulting from interaction with, or absorption in specific tissue (Hall J *et.al*, 1994; Marks R. & de Palma F, 1999; Basford JR. 1990).

The price of a unit depending on the model, would be approximately RM 14 000 to RM16 000. The maintenance cost is estimated to be a few cents/day

2.9 Corona Discharge Device (Sonotron)

An electrosurgical device called the Sonotron emits a corona discharge beam that is created when a low radio-frequency of 430 KHz is modulated by low frequency sound between 1-5 KHz. Dr Alfonso DiMino accidentally discovered it in 1987. It has been said that the energy emitted is equivalent to 1/60 the power of a typical electro-surgical unit in current use and energy

dissipated is equivalent to a pocket calculator (0.023 watt). It has been used to treat a variety of conditions apart from rheumatic aches and pains, including sports injuries, stroke, diabetic ulcers and asthma. The corona beam is placed about 4 cm from the skin of the patient and it is applied for 15 sec.

The exact mechanism of action is not known, but it has been postulated that it is through inactivation of free radicals in the problem area of the patient's body.

This device is approved for use only as an investigational device in USA, and hence can be used freely only outside the US.

The cost of this equipment has been said to be between RM 135, 000 to RM 165,000.

2.10 Topically Applied Capsaicin

Chili peppers have been used as food additives since time immemorial. Columbus is said to have first introduced peppers to the western world in 1492, and since then, peppers have traveled the length and breadth of the globe. The use of chili peppers in folk or traditional medicine is well known, with Nicholas Janson being credited as the first to scientifically investigate the biological effect of capsaicin in 1940. The U.S. FDA classifies capsaicin as a counter-irritant. While the precise mechanism of action is uncertain, the therapeutic effect of capsaicin has been thought to be depletion of substance P from the local sensory nerve terminals

3. OBJECTIVE

To determine the safety, effectiveness and cost implications of heat treatment for degenerative changes of skeletal system

4. METHODOLOGY

4.1 Microwave Hyperthermia

Databases : PUBMED, Best Evidence, DARE, OVID, EBM

Keywords : *microwave, arthritis*

Years : 1990 -2001

Number of titles : 9362

Full text reviewed : 15

Relevant articles : 4

Additional hand search of the specific journals such as Chartered Society of Physiotherapy Journal from 1985- 2000 and Journal of Medical Engineering and Technology from 1980 –1990 was also carried out.

4.2 Short-wave Diathermy

Databases : PUBMED, PREMEDLINE, COCHRANE, Best Evidence, DARE, OVID

Keywords : *short wave diathermy*

Years : 1966 -2000

Number of titles : 453

Full text reviewed : 2

4.3 Interferential Therapy

Databases : PUBMED, COCHRANE, Best Evidence, DARE, OVID
Keywords : *interferential*
Years : 1966 -2000
Number of titles : 129
Full text reviewed :

4.4 Ultrasound

Databases : PUBMED, HEALTHSTAR, OVID
Keywords : *ultrasound, effective, degenerative changes, safety, costs, musculo-skeletal, physiotherapy*
Years : 1990 -2000
Full text reviewed : 11

4.5 Infrared

Databases : PUBMED, Healthcare, TRIP, PEDRO
Keywords : *infrared*
Years : 1968 –2000
Limits : clinical trials, reviews, English
Relevant articles : 4
Full text reviewed : 2

4.6 Hot Packs

Databases : PUBMED, HEALTHSTAR, TRIP, PEDRO
Keywords : *hotpacks*
Years : 1960 –2001
Limits: clinical trials, reviews, English
Relevant articles : 5

4.7 Wax Bath

Databases : PUBMED, Healthcare, TRIP, PEDRO
Keywords : *arthritis, physiotherapy, wax*
Years : 1968 –2000
Limits : clinical trials, reviews, English
Relevant articles : 4

4.8 Laser Therapy

Databases: PUBMED, COCHRANE, DARE, TRIP, EBM Reviews- Best Evidence, .
HEALTHSTAR
Keywords: *Laser, degenerative musculo-skeletal disorder, osteo-arthritis, Rheumatoid arthritis* either singly or in combination.
Limits : English, human, non-surgical technique, clinical trial, clinical review
Year : 1980 - 2000
Number of titles : 61
Relevant abstracts : 20
Full texts reviewed : 12

Four abstracts were included in the analysis, and three excluded due to insufficient information. Hence, 12 full text articles and 4 abstracts were used for final analysis.

4.9 Corona Discharge Device (*Sonotron*)

A search of medical databases like Pubmed did not provide any relevant literature. A search was then made using general search engines, when a web page on Sonotron as well as other relevant web-matches was obtained.

4.10 Tropically Applied Capsaicin

Databases: PUBMED, OVID, EBM Reviews, DARE, HEALTHSTAR, PEDRO, TRIP, Rehabdata.
Keywords: *Heat, Treatment, Osteoarthritis, Capsaicin, Rheumatoid, Pain, Arthritis*, either singly or in combination.
Year : 1990 - 2000
Number of titles : 365
Relevant abstracts : 129
Full texts reviewed : 18

All evidences obtained were graded according to modified CAHTA scale (Appendix A)

5. RESULTS AND DISCUSSION

5.1 *Microwave Hyperthermia*

5.1.1 *Effectiveness*

A study of 9 patients with rheumatic arthritis showed improvement with local deep microwave hyperthermia (Weinberger A. *et.al.*, 1989; Biundo JJ, 1991) A German review suggests that high frequency microwave treatment is beneficial in chronic pain (Sadil V & Sadil S, 1994). This was supported by a Russian study on spinal osteochondrosis (Droviannikova DP *et al*, 1995). Another Russian study on 138 children with juvenile rheumatoid arthritis tested different regimes recommended a combination of microwave therapy with radon or effervescent sulfurated hydrogen baths (Shliapak EA *et al*, 1996)

5.1.2 *Safety*

A study on 7 patients with rheumatoid arthritis with knee effusion treated by local deep microwave hyperthermia showed no adverse reaction (Weinberger A *et.al.*, 1989). Another study by the Food and Drug Administration (FDA) indicated that many microwave equipment lack reliable safety controls to prevent possible overexposure of patients to harmful radiation (Greene J, 1979). Apart from this, there is a possibility of microwave leakage as detected during patient treatment (Kopecky WJ, 1980).

A review on occupational safety of physiotherapists concluded that there is minimal to non-existent health effects of low-level microwave exposure (Jauchem JR, 1998). When the power density levels were measured during microwave treatment sessions, it was determined that physiotherapists are unlikely to be exposed to harmful radiation levels, as long as reasonable care is taken (Moseley H *et.al*, 1981). It was also found that there is a higher risk of miscarriage

among physiotherapists with the use of microwave 6 months prior to pregnancy or during the first trimester (Ouellet – Hellstrom R, 1993).

It can be concluded that there is insufficient evidence to support the effectiveness and safety of microwave therapy for the treatment of musculoskeletal degenerative disease.

5.2 *Short Wave Diathermy*

5.2.1 *Effectiveness*

A review of the literature on the use of SWD in OA of the knee which looked at 11 studies found the studies were of poor methodological quality, and could not establish the effectiveness of SWD (Marks R *et.al.*). There is no evidence for specific effectiveness of the Pulse Short-wave for treatment of OA hip and knee (Moffet JA *et.al.* 1996). A study by Gibson T *et.al.* (1985) where SWD was compared with osteopathic treatment and placebo, found inconclusive evidence on superiority of as all the three groups had similar benefits. A controlled trial of hospital versus home exercise physiotherapy in OA of the knee where one group had SWD and exercise, while the other had exercised alone, showed a reduction in pain and improved function in both groups. (Chamberlain MA *et al*, 1982) SWD reduced the amount of energy dissipated in the joints of the patients. (Yung P *et al*, 1986)

5.2.2 *Safety*

A study done by Pachocki KA *et.al.* (1991) showed that workers exposed to electromagnetic fields, did not have a significantly increased risk of developing leukemia. It was also found to be safe in women with copper bearing IUCD (Heick A, *et al*, 1991). SWD has been found to have a definite adverse influence on some cardiac pace-markers, with an increase or decrease in pace-marker rate or rhythm, ventricular fibrillation, total loss of pacing, or cessation of impulses (Jones SL, 1976). However, a subsequent study by Vergassola R. *et.al.* (1994) showed no changes in pacemakers as a result of the use of different electromagnetic energy sources including SWD. To reduce the exposure of operators to radio-frequency during SWD, it has been suggested that the operator stand at the end of the diathermy console opposite the applicator and cables, while changes to the design of the diathermy console was also suggested. (Skotte J, 1986) A study of the exposure to the operator and patient during SWD found that the intense fields around the applicators and the cables extend up to 0.5 m, and are a source of potential overexposure to the operator (Stuchly MA *et.al*, 1982) Despite this, an evaluation of the radiofrequency exposure from therapeutic diathermy equipment found that there is little chance of immediate harmful effects of electromagnetic fields leakage from the diathermy. Nonetheless, physiotherapists should be advised to remain at a distance of at least 20cm from the electrodes and cables to avoid possible overexposure (Li CY & Feng CK 1999).

A study on the effects of local application of heat on intra-articular and skin surface temperatures suggest that the use of SWD may be harmful in patients with arthritis since it raises intra-articular temperature (Oosterveld FG *et.al*, 1992).

Thus it can be concluded that there is insufficient evidence to support the effectiveness and safety of short wave diathermy in treatment of degenerative changes in skeletal system.

5.3. Interferential Therapy

5.3.1 Effectiveness

A case report by Brouilte DL *et.al*, (1994) found that combination of interferential therapy (IT) with chiropractic manipulative therapy and longitudinal cervical traction seems to be a reasonable alternative to surgery, for a patient with cervical radiculopathy caused by a herniated cervical disc. A randomized controlled trial of spinal manipulation and electrotherapy in patients with acute low back pain, by Hurley DA *et al*, (1999) showed an improvement in pain and functional disability. This is supported by a randomized trial comparing IT with motorized lumbar traction and massage in low back pain by Werner R, *et al*, (1999), which also reported improvement in pain and disability, but there was no difference in the improvement between the two groups. Another randomized trial comparing IT, ultrasound and exercise therapy in soft tissue shoulder disorder found that neither IT nor ultrasound was effective as adjuvant to exercises therapy for (Van der Heijden GJ *et.al.*, 1999). A review by Johnson MI (1999) suggested a need for placebo controlled randomized clinical trials to assess the effectiveness of IT in relieving pain as well as a randomized controlled trial comparing IT with TENS.

5.3.2 Safety

A study on Interferential therapy machines as possible vehicles for cross infection showed that suction cups and sponges were contaminated with microorganism during treatment and have the potential to transfer microorganism from one to another if not disinfected adequately after use (Lambert I & Tebbs SE, 2000)

Thus, there is insufficient evidence to support the effectiveness and safety of interferential therapy in treating musculo-skeletal degenerative disorders.

5.4 Ultrasound

A systematic review of ultrasound (U/S) pre-exercise diathermy found that it provides no benefit in terms of pain reduction or improvement in function when added to an exercise program in patients with osteoarthritis of the hip and knee (DARE, University of York; 2001). Another systemic review of randomized clinical trials of physiotherapy for patients with soft tissue shoulder disorders found no evidence that U/S was more effective than cold therapy and steroid injection, non-steroidal anti inflammatory drugs and acupuncture, TENS, analgesics and iontophoresis, or placebo (DARE, University of York; 2001). A meta analysis of effectiveness of U/S in musculo-skeletal disorders also did not find any improvement with U/S (DARE, University of York; 1996). No conclusive clinically relevant effects of ultrasound treatment were found except for epicondylitis lateralis in another systematic review of randomized controlled trials (Bouter LM, 2000). A randomized clinical trial of the effect of U/S in mobility of the knee in osteoarthritis (OA), comparing exercise and U/S with exercise and no U/S found no significant differences in improvements in range of movement and pain, although there was significant improvement in both groups (Falconer J *et.al*, 1992). A systematic review done by Marks R *et al*, (2000) on the use of U/S in osteoarthritis of the knee found evidence of efficacy of U/S in only study, but the study had major flaws. The remaining studies that found either equitable outcomes or no benefit of U/S were similarly flawed. This review concluded that further research is required to establish the effectiveness of U/S.

A study done by Ray Marks, *e al*, (1997) on symptomatic OA of the knee with combination of various physiotherapy modalities including U/S found functional improvement, but this could

not be attributed solely to U/S. A comparison of 3 different physiotherapy treatments (wax, ultrasound, and ultrasound with faradic hand bath) together with exercise, in 30 patients with rheumatoid arthritis (RA) of the hands, also showed functional improvement, but again this could not be attributed to U/S alone since exercise was also used (Hawkes *et.al*, 1986). A similar study in 18 patients with RA involving multiple physiotherapy modalities, found no significant long-term changes in the joint stiffness parameters, but torque range and energy dissipation were reduced temporarily by a single application of wax plus U/S (Bromley *et.al*, 1994). Another study also found that U/S reduced the amount of energy dissipated in the joints of the patients. (Yung P *et.al* 1986).

Other studies with multiple physiotherapy modalities also showed functional improvement (Jan MH & Lai JS, 1991; Kolchin IM *et.al.*, 2000; Krasil'nikov RG, *et al*, 1991; Grogor'eva VD *et.al.*, 1996). A comparison of the effectiveness of U/S and TENS found that the latter had better clinical response (Saveriano G *et.al.*, 1986).

Again, there is inconclusive evidence to support the effectiveness of ultrasound for the treatment for musculo-skeletal degenerative disease.

5.5 Infrared

A randomized controlled trial in 50 patients with osteoarthritis of the knee comparing red, infrared and placebo found that infrared and red beam therapies are beneficial in pain relief and improvement of function (Stelian J et.al., 1992). Another non randomized trial in patients with carpal tunnel syndrome comparing multiple treatment modalities showed significant pain relief and it was also cost-effective (Branco K et.al., 1999).

Thus, there is insufficient evidence to support the effectiveness and safety of infra red therapy in treating musculo-skeletal degenerative disorders.

5.6 Hot Packs

The short term efficacy (24 hours) of hot mud packs shows no significant improvement in visual analog scale and dolorimetry (pressure tenderness compared to cold therapy. (Samborski W et al, 1992) In contrast there is significant improvement after cold therapy after 2 hours and even at 24 hours. However the pain score values showed a slight decrease immediately after hot mud-pack application.(Milligan AJ, 1984).

A study on the effects of local application of heat on intra-articular and skin surface temperatures suggest that the use of superficial hot packs may be harmful in patients with arthritis since it raises intra-articular temperature (Oosterveld FG *et.al.*, 1992).

Thus, there is insufficient evidence to support the effectiveness and safety of hot packs therapy in treating musculo-skeletal degenerative disorders.

5.7 Wax Bath

In a comparison of temperatures across various superficial heat modalities, it was found that wax was more effective than diathermy at a depth of 1.2 cm, and also better than ultrasound in raising

temperatures (Borrell RM *et al*, 1980). Wax bath alone does not appear to be effective in reducing pain or stiffness (Bromley J *et.al*, 1994; Delhag B *et al*, 1992; Stewart M *et al*, 1996; Yung P *et al*, 1986).). However, used in conjunction with other modes of physiotherapy such as ultrasound and exercise, significant improvements in pain reduction, grip strength, range of motion, time task and checklist of activities were noted (Bromley J *et al*, 1994, Delhag B *et al*, 1992, Yung P *et al*, 1986).

Thus, there is inconclusive evidence to support that wax bath is effective for musculoskeletal degeneration.

5.8 Laser Therapy

Rheumatoid Arthritis

A meta-analysis of 5 RCTs with a total sample size of 204 patients suggest that laser can reduce pain, but there was no long-term effect on follow-up (Brousseau L *et.al*, 2000). Fulga C (1998) reported beneficial results of laser therapy in a clinical trial on 60 patients in the treatment of rheumatoid arthritis. While there was improvement in both local pain and local inflammation, the improvement was more marked in local inflammation. Another randomized trial of 32 patients with arthralgic temporomandibular joints (TMJ) treated with mid-laser also found pain reduction and improvement in TMJ biomechanics (Bertolucci LE *et al.*, 1995).

Hall *et al*, (1994) in a RCT of 40 patients concludes that low level laser therapy is ineffective in the management of rheumatoid arthritic finger joints. Another double-blind RCT of low power laser treatment in rheumatoid arthritis by Heussler JK *et.al*, (1993), contralateral hands were used as control. The trial concluded that laser had no clinical relevance in the treatment of rheumatoid arthritis. On the other hand, Bouter LM (2000) concluded that there is insufficient scientific evidence for the efficacy of laser therapy in physiotherapy with the possible exception of rheumatoid arthritis.

With respect to safety, a meta-analysis concluded that there was no adverse effect of laser therapy (Brousseau L *et.al*, 2000). A randomized trial in 25 patients also did not find any significant difference in side effects in both control and intervention groups (Heussler JK *et.al.*, 1993). Another clinical trial of 60 patients also did not find any adverse effects (Fulga C, 1998) while another study of 136 patients too had a similar finding (Fulga C *et.al.*, 1994).

Osteoarthritis

In a double blind RCT by Walker J (1983), 4 out of 5 patients with osteoarthritis (OA) had relief from chronic pain by low power laser irradiation, and they were pain-free after 6 months. Another randomized controlled trial on the effect of mid-laser on degenerative joint disease of the temporomandibular joint done by Lawrence E, *et al*, (1995) showed that it produced significantly greater changes than the placebo group ($p < 0.05$). Further, another study of 372 patients concluded that treatment with laser had substantially reduced the symptoms as well as improved the quality of life of the patients with OA of the cervical vertebrae and coxa (Tam G, 1999). In their review of 6 randomized controlled clinical trials, Mark R and de Palma F (1999) found that 4 studies demonstrate positive treatment effect on Osteoarthritis. Thus, they concluded

statistically superior results in laser treatment, although there is a caution on shortcomings in study designs.

On the other hand, Bullock PM, *et.al*, (1994) in a RCT, failed to demonstrate any significant difference between the placebo and treatment group, though significant improvements were reported within both groups. Similarly, a RCT by Basford JR *et.al* (1987) also failed to show a significant difference between treatment and placebo groups since half the patients from each group felt they have benefited from the treatment. Thus, the author concluded that patients with osteoarthritis of thumbs do not benefit from laser treatment. A meta-analysis by Brousseau L, *et.al*, (2000) on low level laser therapy in the treatment of osteoarthritis analysed 5 RCT's with a total of 197 patients. For the primary outcome of pain, there was no significant difference, though it favoured laser. The final outcome was that there was inconclusive evidence regarding the use of laser for treatment of osteoarthritis. Another meta-analysis by Beckerman H *et.al*, (1992), of 36 RCT's involving 1704 patients with musculoskeletal and skin disorders, found that only 7 were of good quality. Of these, 3 favoured laser therapy while 2 studies reported no significant difference. The other 2 studies used incorrect statistical analysis. However, some of the studies suggest that laser therapy is effective.

There is no significant side effect of the laser use (Bullock PM *et al*, 1994; Basford JR *et al*, 1987). A meta-analysis showed that while most studies observed no side effects, some others reported transient tingling, mild erythema, burning sensation, increased pain, numbness and skin rash (Beckerman H *et al*, 1992)

There is inconclusive evidence to support that laser is effective for the treatment of musculoskeletal degenerative disease, although it appears to be a safe modality.

5.9 Corona Discharge Device (*Sonotron*)

A study done on the effects of this therapy showed that patients had long duration of pain relief averaging about a year after stopping therapy (Chiaki Wada *et al*, 1995). Another study showed that there is significant pain relief and improved range of motion with Sonotron with no significant side effect noted on any patient (Koji Sato *et al*, 1995). An unpublished case-series on 73 patients, it is reported that 71 of them (97.3%) had some alleviation of pain, while 56 (76.7%) had increased joint use (Cohen L *et al*, 1996). Another unpublished case series on 24 patients for a 6-month period in, reported that 20 patients had improvement in pain (Greenberg LM, 1995). Other trials are reported to have been conducted in universities and private centers but they appear to be phase II trials.

With respect to safety, this equipment has been certified by the Canadian Standards Association.

It is concluded that there is inconclusive evidence to support the Sonotron is effective & safe for treatment of musculoskeletal degeneration disease.

5.10 Capsaicin

Rheumatoid Arthritis

A RCT by Deal CL *et al*, (1991) found that there is significantly more relief of pain reported by the capsaicin treated patients compared to placebo, and this relief was sustained throughout the duration of the study of four weeks. However, a RCT on 7 patients found no difference in tenderness and pain in RA and no effect on grip strength, duration of morning stiffness, and function (McCarthy GM & McCarty DJ, 1992).

With respect to safety, transient or local burning was felt at the site of drug application (McCarthy GM & McCarty DJ, 1992; Deal CL *et al*, 1991).

Osteoarthritis

In a systematic review of pharmaceuticals in the treatment of osteoarthritis (OA) by Towheed TE, *et al*, (1997), the results of 1 RCT on capsaicin showed some merit. Wollheim FA, 1996, expresses a similar view in a review. A RCT by McCarthy GM & McCarty DJ (1992) on 14 patients showed that capsaicin reduced tenderness and pain in OA, but there was no effect on grip strength, duration of morning stiffness and function. This finding was supported by Deal CL *et al*, (1991) in a double blind trial in 70 patients with OA where there was significant pain relief. This was supported by a review by Rosenstein ED (1999) who concluded that topical capsaicin is a potentially beneficial therapy for the treatment of OA of selected joints. Another review suggests that capsaicin should be considered as adjuvant therapy in OA (Rains C & Bryson HM, 1995). A meta-analysis of RCTs by Zhang WY *et al*, (1994) concluded that capsaicin is better than placebo in providing pain relief in osteoarthritis (OR =2.80;95% CI= 2.77, 6.88. A systematic review of physical modalities by Nocholas JJ (1994) suggested capsaicin could provide pain relief in osteoarthritis if it is possible to deliver the treatment fully and persistently.

A systematic review of non-medicinal and non-invasive therapies suggests that while capsaicin reduces pain in OA of the knee, more data is needed to evaluate its role (Puett DW & Griffin MR, 1995). A similar view is expressed in another review (Rumsfield JA & West DP, 1991).

Considering safety, stinging and burning, particularly during the first week of therapy, was felt at the sites of drug application, and there was initial discomfort (McCarthy GM & McCarty DJ. 1992; Rains C & Bryson HM 1995; Deal CL *et al*, 1991; Zhang WY *et al*,. 1994)

It can be concluded that capsaicin is safe and useful for treating osteoarthritis, but there is insufficient evidence of its effectiveness in treating rheumatoid arthritis. .

5.11 Local Situation

Introduction

A survey was conducted of the Ministry of Health Malaysia hospitals in order to obtain information on the local situation with reference to heat treatment for degenerative changes of skeletal system. It was confined to those hospitals that have either an Orthopaedic or general surgeon, who manage patients with degenerative changes of bone.

Objective

This survey was conducted to determine the various practices for treating patients with degenerative changes, and to identify the various modalities of therapy that are available and being used for treating these patients in hospitals.

Methodology

Study design– a descriptive study design was adopted for the purpose of this survey. The *study population and sampling frame* of this study are Ministry of Health Malaysia hospitals that have physiotherapists and either an orthopaedic or general surgeon. *Thirty-six* hospitals that fulfilled the inclusion criteria of having both groups of personnel were surveyed. This would mean that the *study sample* was 72 (36 pairs). The *study instrument* used was a self-filled questionnaire.

Results

i) Response rate

There was an overall response rate of 58.33% (42 responses), with 77.8% response from the physiotherapists while only 38.9% surgeons responded. This also meant that 28 of the 36 hospitals surveyed, responded to the questionnaire.

ii) Availability of various modalities of heat therapy

Almost all modalities of heat therapy under study were available in these hospitals. These included short wave diathermy (SWD), microwave (MW), interferential therapy (IT) ultrasound (US), infrared (IR) and wax that are available in all 28 hospitals that responded. Three hospitals did not have transcutaneous electrical nerve stimulation (TENS), while hot packs (HP) and laser are available in 19 and 18 hospitals respectively.

iii) Hospital workload

The level of utilization of heat therapy rehabilitative equipment was estimated for one month, in January 2001. Data on the nine modalities under study and the results were as shown in Table 2.

Table 2: Distribution of workload of nine modalities of heat therapy in 28 MOH hospitals

Modalities	Number of treatments			
	Minimum	Median	Maximum	Mean
Short wave diathermy	14	159.0	694	207.7
Microwave	0 (21)	0	86	10.9
Interferential	0 (2)	94.9	263	94.9
Ultrasound	25	50.6	237	72.1
Infrared	0 (2)	103.0	497	118.9
Wax	5	64.0	792	127.0
Transcutaneous Electric Nerve Stimulation (TENS)	0(8)	10.0	270	29.7
Hot Pack	0 (9)	18.0	648	103.5
Laser	0 (17)	0	69	7.3

Note: () number of hospital

Choice of treatment in six medical conditions

There were 6 medical conditions that this survey focused on, namely, osteoarthritis, rheumatoid arthritis, trauma, low back pain, degenerative disease and inflammatory disease. Each respondent was asked to indicate his/her choice(s) of treatment of the 6 medical conditions. Table 2 – 7 below showed the choices (%) of treatment from the two categories of personnel.

i. Treatment of choice for osteoarthritis

As Table 3 below shows, both surgeons and physiotherapists opt for short wave diathermy (*) for osteoarthritis while laser is the least preferred (#) mode of therapy.

Table 3: Choice of treatment for osteoarthritis by category of personnel

Heat Therapy Modalities	Category of personnel (%)	
	Surgeon	Physiotherapist
Short Wave Diathermy*	85.7	96.3
Micro wave	21.4	7.4
Interferential Therapy	50.0	63.0
Ultrasound	42.9	40.7
Infrared	57.1	77.8
Wax	28.6	29.6
Transcutaneous Electrical Nerve Stimulation	28.6	25.9
Hot Pack	42.9	44.4
Laser#	7.1	3.7

ii Treatment of choice for rheumatoid arthritis

Wax (*) is the preferred mode of therapy for rheumatoid arthritis by both surgeons and physiotherapists, whilst microwave is the least preferred as seen in Table 4 below:.

Table 4: Choice of treatment for rheumatoid arthritis by category of personnel

Heat Therapy Modalities	Category of personnel (%)	
	Surgeon	Physiotherapist
Short-wave diathermy	57.1	29.6
Micro wave #	7.1	3.7
Interferential therapy	28.6	40.7
Ultrasound	21.4	11.1
Infrared	64.3	92.6
Wax*	71.4	100.0
Transcutaneous electrical Nerve Stimulation	14.3	14.8
Hot Pack	50.0	48.1
Laser	7.1	29.6

iii *Treatment of choice for trauma*

The surgeons seem to use wax and hot packs while the physiotherapists prefer ultrasound and wax for treating trauma, as shown below:

Table 5: Choice of treatment for trauma by category of personnel

Modalities	Category of personnel (%)	
	Surgeon	Physiotherapist
Short-wave diathermy	38.5	44.4
Micro wave #	7.7	7.4
Interferential Therapy	53.8	70.4
Ultrasound	61.5	85.2
Infrared	53.8	77.8
Wax*	69.2	81.5
Transcutaneous Electrical Nerve Stimulation (TENS)	38.5	48.1
Hot Pack	61.5	63.0
Laser	7.7	25.9

iv. *Treatment of choice for low back pain*

As illustrated in Table 6 below, all the surgeons included short wave diathermy in their choice of therapy for the treatment of low back pain, apart from other modalities, excepting wax. The physiotherapists, similarly also use short wave diathermy and interferential therapy.

Table 6: Choice of treatment for low back pain by category of personnel

Modalities	Category of personnel (%)	
	Surgeon	Physiotherapist
Short –wave diathermy*	100.0	96.3
Micro wave	21.4	25.9
Interferential Therapy	64.3	92.6
Ultrasound	57.1	66.7
Infrared	64.3	77.8
Wax #	0	7.4
Transcutaneous Electrical Nerve Stimulation (TENS)	57.1	74.1
Hot Pack	57.1	63.0
Laser	7.1	14.8

v *Treatment of choice for degenerative conditions*

All surgeons and physiotherapists in this survey chose short wave diathermy for the treatment of degenerative conditions and both groups use wax least for this condition.

Table 7: Choice of treatment for degenerative conditions by category of personnel

Modalities	Category of personnel (%)	
	Surgeon	Physiotherapists
Short wave diathermy *	100.0	100.0
Micro wave	23.1	22.2
Interferential Therapy	69.2	92.6
Ultrasound	61.5	59.3
Infrared	46.2	70.4
Wax #	7.7	7.4
Transcutaneous Electrical Nerve Stimulation	61.5	63.0
Hot Pack	61.5	44.4
Laser	15.4	14.8

vi *Treatment of choice for inflammatory conditions*

Ultrasound is used by all physiotherapists to treat inflammatory conditions and the surgeons too prefer this modality compared to others. For both groups, microwave is the least preferred mode of therapy

Table 8: Choice of treatment for inflammatory conditions by category of personnel

Modalities	Category of personnel (%)	
	Surgeon	Physiotherapists
Short wave diathermy	58.3	51.9
Micro wave #	8.3	18.5
Interferential Therapy	66.7	70.4
Ultrasound*	83.3	100.0
Infrared	50.0	63.0
Wax	33.3	70.4
Transcutaneous Electrical Nerve Stimulation	41.7	59.3
Hot Pack	50.0	37.0
LASER	16.7	55.6

Agreement on choice of treatment

The choices of treatment for six selected conditions were compared between surgeons and physiotherapists. This information could only be analyzed on 14 hospitals since an analysis of agreement could only be carried out if both groups of personnel from the same hospital responded. This data looked at the modality (ies) of treatment selected by both of surgeon and

physiotherapist from the same hospital for the six medical conditions regardless of number of choices each person had.

i Agreement on choice of treatment for osteoarthritis

Five hospitals had total agreement on choice of treatment for osteoarthritis and the modalities used ranged from 2 (Mentakab Hospital) to 7 (TAR Hospital, Klang). Pulau Pinang Hospital used 4 modalities to treat osteoarthritis but the surgeon and the physiotherapist were not in tandem in their use.

Table 9: Agreement on choice of treatment for osteoarthritis

Hospital	Category of personnel (%)		
	% Agreement		
	Surgeon	physiotherapist	
Batu Pahat	4	4	100.0
Ipoh	6	6	100.0
Kajang	4	1	25.0
Keningau	3	3	100.0
Tengku Ampuan Rahimah Klang	7	7	100.0
Kuala Pilah	4	8	50.0
Sri Manjung	2	6	33.3
Melaka	1	6	16.6
Mentakab	2	2	100.0
Muar	3	5	60.0
Pulau Pinang	2	2	100.0
Sungai Petani	1	5	20.0
Sibu	2	5	40.0
Tengku Ampuan Afzan Kuantan	4	7	57.0

ii Agreement on choice of treatment for rheumatoid arthritis

There were three to four choices of treatment where both groups were totally agreeable on their use for treatment of rheumatoid arthritis. There were two hospitals where there was complete disagreement on the modes of therapy by both surgeons and physiotherapists.

Table 10: Agreement on choice of treatment for rheumatoid arthritis

Hospital	Category of personnel		% Agreement
	Surgeon	Physiotherapist	
Batu Pahat	4	4	100.0
Ipoh	3	3	100.0
Kajang	1	3	0.0
Keningau	3	3	100.0
Tengku Ampuan Rahimah Klang	4	4	100.0
Kuala Pilah	2	3	66.6
Sri Manjung	2	6	33.3
Melaka	1	4	0.0
Mentakab	3	3	100.0

Muar	2	6	33.3
Pulau Pinang	4	4	100.0
Sungai Petani	1	6	16.6
Sibu	3	6	50.0
Tengku Ampuan Afzan Kuantan	3	7	42.0

iii Agreement on choice of treatment for trauma

Two hospitals (*) did not use heat therapy for treating trauma cases. Among those who responded, the agreement was between 28.5 – 100.0%, with up to 8 modalities of heat therapy being used to treat trauma.

Table 11: Agreement on choice of treatment for trauma

Hospital	Category of personnel		% Agreement
	Surgeon	Physiotherapist	
Batu Pahat	6	6	100.0
Ipoh	4	4	100.0
Kajang*	0	0	0.0
Keningau	2	2	100.0
Tengku Ampuan Rahimah Klang	7	7	100.0
Kuala Pilah	2	7	28.5
Sri Manjung	0	0	0.0
Melaka	2	5	40.0
Mentakab	4	4	100.0
Muar	2	7	28.5
Pulau Pinang	7	7	100.0
Sungai Petani	3	8	37.5
Sibu	4	8	50.0
Tengku Ampuan Afzan Kuantan	2	6	33.3

iv Agreement on choice of the treatment for low back pain

Table 11 shows there were up to 8 modalities of heat therapy used for the treatment of low back pain. All hospitals showed varying degrees of agreement in treating this condition ranging from 20.0- 100.0%. The surgeon from Kajang Hospital selected only a single modality of heat therapy for treating low back pain.

Table 12: Agreement of choice for the treatment of low back pain

Hospital	Category of personnel		% Agreement
	Surgeon	Physiotherapist	
Batu Pahat	7	7	100.0
Ipoh	7	7	100.0
Kajang	1	5	20.0
Keningau	4	5	80.0

Tengku Ampuan Rahimah Klang	6	6	100.0
Kuala Pilah	5	7	71.4
Sri Manjung	3	8	37.5
Melaka	4	6	66.6
Mentakab	4	4	100.0
Muar	5	7	71.5
Pulau Pinang	4	4	100.0
Sungai Petani	2	4	50.0
Sibu	3	7	42.8
Tengku Ampuan Afzan Kuantan	5	6	
83.0			

v. *Agreement on choice of treatment for degenerative conditions*

As can be seen in Table 13, up to nine modalities of therapy was used to treat these conditions, the larger numbers coming from the physiotherapist.

Table 13: Agreement on choice of treatment for degenerative conditions

Hospital	Category of personnel		% Agreement
	Surgeon	physiotherapist	
Batu Pahat	6	6	100.0
Ipoh	8	8	100.0
Kajang	1	4	25.0
Keningau	3	4	75.0
Tengku Ampuan Rahimah Klang	6	6	100.0
Kuala Pilah	4	9	44.4
Sri Manjung	3	8	37.5
Melaka	4	6	66.6
Mentakab	2	3	66.6
Muar	3	7	42.8
Pulau Pinang	3	3	100.0
Sungai Petani*	0	0	
0.0			
Sibu	3	7	42.8
Tengku Ampuan Afzan Kuantan	5	6	
83.3			

vi. *Agreement on choice of treatment for inflammatory conditions*

Of the six identified medical conditions in this survey, inflammatory conditions showed the least degree of agreement in choices of treatment using heat therapy (only 2 hospitals) among surgeons and physiotherapists.

Table 14: Agreement on choice of treatment for inflammatory conditions

Hospital	Category of personnel		% Agreement
	Surgeon	Physiotherapist	
Batu Pahat	4	5	80.0
Ipoh	5	5	100.0
Kajang	1	6	16.6
Keningau	4	5	80.0
Tengku Ampuan Rahimah Klang	5	6	83.3
Kuala Pilah	3	7	42.8
Sri Manjung*	0	0	0.0
Melaka	2	6	33.3
Mentakab	2	2	100.0
Muar	3	7	42.8
Pulau Pinang	4	5	80.0
Sungai Petani*	0	0	0.0
Sibu	2	7	28.5
Tengku Ampuan Afzan Kuantan	4	7	57.1

6. CONCLUSION

It can be concluded that there is insufficient evidence to support the effectiveness and safety of microwave therapy, short wave diathermy, interferential therapy, infra red therapy hot packs therapy for the treatment of musculoskeletal degenerative disease.

In addition, there is inconclusive evidence to support the effectiveness of ultrasound, wax bath, laser, and corona discharge (Sonotron) for the treatment for musculo-skeletal degenerative disease.

However, it can be concluded that capsaicin is safe and useful for treating osteoarthritis, but there is insufficient evidence of its effectiveness in treating rheumatoid arthritis. .

A local survey shows that there is variation in selection of the modality of treatment by surgeons and physiotherapists for some common conditions including musculoskeletal degenerative disease.

7. RECOMMENDATION

There is a need for greater standardization of treatment for common conditions requiring heat treatment.

More studies need to be carried out at the local level to examine the effectiveness of some of these modalities.

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65. Saveriano G *et al, Our Experience In The Use Of A New Objective Pain Measuring System In Rheumarthropatic Subjects Treated With Transcutaneous Electroanalgesia And U/S* Minerva Medica 1986 Apr 28; 77(18): 745-52
66. Shliapak EA Gabidova NT *et al, The Ehf Therapy Of Children With Juvenile Rheumatoid Arthritis* Voprosy Kurortologii, Fizioterapii I Lechebnoi Fizicheckoi Kultury 1996 Nov - Dec; (6) :19-21
67. Skotte J *Reduction Of Radiofrequency Exposure To The Operator During SWD.* Journal of Medical Engineering and Technology 1986 Jan;10 (1) 7-10,
68. Stelian J Gil I *et al, Improvement Of Pain And Disability In Elderly Patients With Degenerative Osteoarthritis Of The Knee Treated With Narrow -Band Light Therapy* Journal of the American Geriatrics Society 1992 Jan; 40(1):23-6

69. Stewart M *Researches Into The Effectiveness Of Physiotherapy In Rheumatoid Arthritis Of The Hand* Physiotherapy 1996 Dec; 82(12):666-71
70. Stuchly MA, Repacholi MH *et al*, *exposure to the operator and pat. During SWD Treatment* Health Physics 1982 Mar; 42 (3): 341-66
71. Tam G *Low Power Laser Therapy and Analgesic Action* J Clin Laser Med Surg 1999 Feb; 17(1) 29-33
72. Towheed TE, Hochberg MC *A Systematic Review Of Randomized Controlled Trials Of Pharmacological Therapy In Osteoarthritis Of The Knee, With An Emphasis On Trial Methodology* Semin Arthritis Rheum 1997 Apr; 26(5): 755-70
73. Van der Heijden GJ, Leffers P, Wolters PJ *No effect of bipolar IT and Pulsed US for soft tissue disorders* Annals of the Rheumatic Diseases 1999 Sept; 58 (9): 530-40.
74. Vergassola R, Borgioli A *et al*, *Changes in pacemaker and the wearers of pacemakers as a result of the use of different electromagnetic energy source (Italian)* Minerva Cardioangiologica 1994 Jan-Feb; 42 (1-2):27-32
75. Walker J *Relief from Chronic Pain by Low Power Laser Irradiation*. Neuroscience Letters, 43 (1983) 339-344.
76. Weinberger A, Fadilah R. *et al*, *Treatment of articular effusion with local deep microwave hyperthermia* Clinical Rheumatology 1989 Dec; 8(4): 461- 6
77. Werner R, Pynsent, PB. *Randomised Trial Comparing It With Motorised Lumbar Traction And Massage In The Mx Of Low Back Pain In The Primary Care Setting* Spine 1999; 24 (15): 1579-84
78. Wollheim FA *Current Pharmacological Treatment Of Osteoarthritis* Drugs 1996 52 Suppl 3: 27-38
79. Yung P, Unsworth A & Haslock I *Measurement Of Stiffness In The Metacarpophalangeal Joint: The Effect Of Physiotherapy* Clinical Physics & Physiological Measurement 1986 May, 7: 147-56
80. Zhang WY; Li Wan Po. *The Effectiveness Of Topically Applied Capsaicin: A Meta Analysis*. Eur J Clin Pharmacol 1994; 46(6): 517-22.

**9. EVIDENCE TABLE
MICROWAVE**

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
EFFECTIVENESS				
1.	Weinberger A. Fadilah R. <i>et al</i> , Treatment of articular effusion with local deep microwave hyperthermia Clinical Rheumatology 1989 Dec; 8(4): 461- 6	Uncontrolled 7 RA with knee effusion treated with local deep microwave hyperthermia (LDMWH) 915 MHz 1 Hr , 2/week, for 2 weeks	Walking time improved and significant decrease in pain after treatment and remain stable on 6 weeks follow up Conclusion ; LDMWH to be safe and successful as an adjuvant treatment of chronic inflammatory joint effusions No adverse reaction	Poor
2.	Biundo JJ Jr, Torres Ramos FM Rehabilitation and biomechanics Current opinion in Rheumatology 1991 Apr; 3(2) 291-9		Local deep microwave hyperthemia appears to have potential therapeutic benefit	
3.	Shliapak EA Gabidova NT <i>et al</i> , The EHF therapy of children with juvenile	Uncontrolled 138 children with JRA 3 regimens used.	The best results were achieved at the exposure of the thymic acupuncture points and most affected joint. Combination of microwave therapy with radon or effervescent sulfurated hydrogen baths is also recommended	Poor

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
	rheumatoid arthritis Voprosy Kurortologii, Fizioterapii I Lechebnoi Fizicheckoi Kultury 1996 Nov - Dec; (6) :19-21			
4.	Sadil V. Sadil S Electrotherapy (Review) Wiener Medizinische Wochenschrift. 144 (20 -21):509 -20, 1994	Review	Short & microwave treatment (high frequency) prove to be beneficial in chronic pain	
5.	Droviannikova DP Volobuev AN <i>et al</i> , The mechanism of the therapeutic action of the EHF therapy of the spinal osteochondrosis Voprosy Kurortologii, Fizioterapii I Lechebnoi Fizicheckoi Kultury 1995; (2) :25-6	Not Stated	Pain alleviated, muscular tension decreased, movement recovered, convulsion and numbness of the legs ceased	

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
SAFETY				
1.	<p>Ouellet – Hellstrom R</p> <p>Miscarriages among female physical therapist who report using radio and microwave –frequency electromagnetic radiation</p> <p>American Journal of Epidemiology. 1993 Nov 15; 138 (10): 775-86</p>	<p>42,403 mailed Questionnaires</p> <p>Nested case control design</p>	<p>Higher risk of miscarriage (OR 1.28 CI 95% =1.02-1.59))-use 6 months prior to pregnancy or during first trimester. Odds ratio increased with increasing levels of exposure to microwave(P, 0.005)</p> <p>Risk of miscarriage not associated with shortwave equipment</p>	<p>good</p> <p>Bias with 6 months prior to pregnancy (personal opinion)</p>
2.	<p>Jauchem JR</p> <p>Health effects of microwave exposures : a review of the recent (1995- 1998) literature</p> <p>Journal of microwave power & Electromagnetic</p>	<p>Review</p>	<p>Health effects of low-level microwave exposure is minimal to non-existent</p>	<p>Poor</p>

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
	Energy 1998; 33(4) : 263- 74			
3.	Weinberger A. Fadilah R. <i>et al</i> , Treatment of articular effusion with local deep microwave hyperthermia Clinical Rheumatology 1989 Dec; 8(4): 461- 6	Uncontrolled 7 RA with knee effusion treated with local deep microwave hyperthermia (LDMWH) 915 MHz 1 Hr , 2/week, for 2 weeks	Walking time improved and significant decrease in pain after treatment and remain stable on 6 weeks follow up Conclusion ; LDMWH to be safe and successful as an adjuvant treatment of chronic inflammatory joint effusions No adverse reaction	Poor
4.	Moseley H Davison M Exposure of Physiotherapists to microwave radiation during Microwave Hyperthermia treatment Clinical Physics & Physiological Measurements 1981 Aug; 2(3):217 –21	Power density measured 30cm away. ½ of cases reading <10mW cm-2 (max permissible)	Physiotherapist are unlikely to be exposed to radiation levels which would be considered harmful, provided reasonable care is taken	
5.	Greene J		There is lack of reliable safety controls on many of these machines to prevent possible	

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
	<p>Microwave Hyperthermia: the invisible healer</p> <p>FDA Consumer 13 1979 Feb (1):7-11</p>		<p>overexposure of harmful radiation to patients Agency to propose a performance standard that will assure the safety and effectiveness of these medical services.</p>	
6.	<p>Kopecky WJ.</p> <p>Microwave leakage during patient treatment</p> <p>Medical Physics 7 1980 May- Jun (3):259-60</p>		<p>Marked increase of microwave leakage occurring during patient treatment than that which can be predicted from static phantom results.</p>	

SHORT WAVE DIATHERMY

No	Author, Title, Journal, Year	Study Design, Sample Size, Follow up	Outcomes & Characteristic	Grade & Comments
EFFECTIVENESS				
1.	<p>Oosterveld FG, Rsker JJ, Jacobs JW, Overmars HJ</p> <p>The effect of local heat and cold therapy on the intraarticular and skin surface temperature of the knee</p> <p>Arthritis Rheum 1992 Feb; 35(2): 146-51</p>	<p>Controlled Clinical Trial</p> <p>N= 42</p>	<p>The use of superficial heat packs in the treatment of patients with arthritis may potentially cause harm by increasing intra-articular temperature,</p>	
2.	<p>Moffet JA, Richardson PH, Frost H, Osborn A.</p> <p>A placebo controlled double blind trial to evaluate the effectiveness of pulsed SWD for osteoarthritic hip and knee pain.</p>	<p>Placebo controlled double blind trial</p> <p>92 patients:- Active PSW - Placebo PSW - No Treatments</p>	<p>No evidence was found for specific effectiveness of PSW for Treatment of OA hip and knee.</p> <p>Comments by John Low ----Low watts – 23/24 used in this study compared to previous studies</p>	Fair

No	Author, Title, Journal, Year	Study Design, Sample Size, Follow up	Outcomes & Characteristic	Grade & Comments
	Pain 1996 Sept; 67(1) :121-7			
3.	Gibson T., Graham R., Woo P., Blagrove P., Hills R., Harkness J. Controlled comparison of SWD treatment with osteopathic Rx in non- specific low back pain. The Lancet 1985 June 1;1(8440): 1258-61	Randomized controlled trial 109 patients – SWD vs placebo (detuned SWD) vs spinal manipulation.	Inconclusive evidence on superiority of SWD as all 3 groups had similar benefits.	Fair
4.	Marks R, Ghassemi M, Duarte R, Van Nguyen JP A review of the lit on SWD as applied to OA of the knee Physiotherapy 85(6): 304-316	11 relevant non randomized comparative and randomized controlled clinical studies	Further controlled studies re essential to established whether either continuous or pulse SWD is efficacious for treating OA knee	Poor Methodology quality
5.	Chamberlain MA, Care G, Harfield B Physiotherapy in OA at the knee. A controlled trial of	Randomized controlled trial 42 patients = SWD + exercise s -24 = Exercises –18	Both groups reported a reduction in pain and improved function , maximum weight lift and endurance at 4 weeks	Poor Small sample Exercises regimen was not standardised

No	Author, Title, Journal, Year	Study Design, Sample Size, Follow up	Outcomes & Characteristic	Grade & Comments
	hospital versus home exercise, International Rehabilitation medicine 1982; 4 (2): 101 – 6			
6.	Yung P <i>et al</i> , Measurement of stiffness in the metacarpophalangeal joint: the effect of physiotherapy Clinical Physics & Physiological Measurement 7(2): 147-56, 1986 May	not stated	SWD and U/S both reduced the amount of energy dissipated in the joints of the patients.	
SAFETY				
1	Pachocki KA, Gajewski AK Exposure to	958 cases of exposure (SWD, heat sealer, capacitor discharge welder and induction welder)	Workers exposed to electromagnetic fields, the odd ratio (OR) was not significantly elevated all leukemias (P> 0.05)	

No	Author, Title, Journal, Year	Study Design, Sample Size, Follow up	Outcomes & Characteristic	Grade & Comments
	<p>electromagnetic field and risk of leukemia</p> <p>Roczniki Panstwowege Zakladu Higieny 1991; 42(3): 217-21</p>	<p>Age matched: not significantly increased</p>		
2	<p>Heick A, Espersen T, Pedersen HL</p> <p>Is Diathermy safe in women with copper bearing IUCD?</p> <p>Acta Obstetricia Scandinavia 1991; 70(2): 153-5.</p>	<p>Not stated</p>	<p>Safe in women with copper bearing IUCD</p>	
3	<p>Jones SL</p> <p>Electromagnetic field interference and cardiac pacemaker</p> <p>Physical therapy 1976 Sept; 56(9):1013-8,</p>	<p>Review of 440 patients with cardiac pacemaker review From 1949 – 197</p>	<p>Short-wave diathermy and Microwave Hyperthermia and electrical stimulators have been found to have a definite adverse influence on some pace-markers. The effect of interference may be an increase or decrease in pace-marker rate or rhythm, ventricular fibrillation, total loss of pacing, or cessation of impulses</p>	

No	Author, Title, Journal, Year	Study Design, Sample Size, Follow up	Outcomes & Characteristic	Grade & Comments
4.	<p>Vergassola R. Borgioli A <i>et al</i>,</p> <p>Changes in pacemaker and the wearers of pacemakers as a result of the use of different electromagnetic energy source (Italian)</p> <p>Minerva Cardioangiologica 1994 Jan-Feb; 42 (1-2):27-32</p>	<p>Studied-SWD, electrosurgical knives , electrotherapy and radio frequencies</p>	<p>No effect</p> <p>Comments: Newer pacemaker less subject to interference from external electromagnetic sources</p>	<p>Poor</p>
5.	<p>Skotte J</p> <p>Reduction of radiofrequency exposure to the operator during SWD.</p> <p>Journal of Medical Engineering and Technology 1986 Jan;10 (1) 7-10,</p>	<p>Not stated</p>	<p>Operator should stand at the end of the diathermy console opposite to the applicator and cables. Advise to modify design of diathermy console.</p>	

No	Author, Title, Journal, Year	Study Design, Sample Size, Follow up	Outcomes & Characteristic	Grade & Comments
6.	<p>Stuchly MA, Repacholi MH <i>et al</i>,</p> <p>Exposure to the operator and pat. During SWD Treatment</p> <p>Health Physics 1982 Mar; 42 (3): 341-66</p>	Not stated	The intense fields around the applicators and the cables extend up to 0.5 m and are a source of potential overexposure to the operator.	
7.	<p>Li CY, Feng CK</p> <p>An evaluation of radiofrequency exposure from therapeutic diathermy equipment.</p> <p>Industrial Health 1999 Oct; 37(4): 465-8</p>	Not stated	There is little chance of immediate harmful effects of electromagnetic fields leakage from the diathermy. Nonetheless, physiotherapy should still be advised to remain at a distance of at least 20 cm from the electrodes and cables to avoid possible overexposure.	

INTERFERENTIAL THERAPY

No	Author, Title, Journal, Year	Study design, Sample size, Follow up	Outcomes & characteristic	Grade & Comments
1.	<p>Brouilte DL, Gurske DT</p> <p>Chiropractic treatment of cervical radiculopathy caused by a herniated cervical disc.</p> <p>Journal of manipulative & physiological therapeutics 1994 Feb; 17(2) 119</p>	<p>A case report on combination therapy with chiropractic manipulative therapy, longitudinal cervical traction and interferential therapy</p>	<p>Pain improved by 60% within 6 weeks, patient pain, numbness and grip strength randomized in 5 months</p> <p>Conservative Rx including chiropractic manipulative therapy seems to be a reasonable alternative to surgery, for cervical radiculopathy caused by a herniated cervical disc.</p>	<p>Poor</p> <p>Case report</p>
2.	<p>Hurley D.A, Baxter G.D, Mcdonough S</p> <p>Randomised controlled trial of spinal manipulation and electrotherapy in the physiotherapy management of acute low back pain</p> <p>The Journal Of Bone And Joint Surgery Br (1999) supplement II ;</p>	<p>Spinal manipulation compared with interferential therapy combined with manipulation or indeed interferential alone</p> <p>Six acute back pain patients</p>	<p>Result showed a statistically significant difference between initial and reassessment values for all measures of pain and functional disability used ($p < 0.05$)</p>	<p>Poor</p> <p>Small sample size Cause of back pain not stated</p>

No	Author, Title, Journal, Year	Study design, Sample size, Follow up	Outcomes & characteristic	Grade & Comments
	81 – B, I : 323			
3.	Werner R, Pynsent, P B. Randomised trial comparing IT with andomize Lumbar Traction and massage in the mx of low back pain in the primary core setting Spine 1999; 24 (15): 1579-84	RCT 152 patients	A progressive fall in owestry Disability Index and pain visual analog scale in patients with low back pain treated with either Interferential therapy or motorized traction and massage. No difference in the improvement between the two groups	Good
4.	Van der Heijden GJ, Leffers P, Wolters PJ No effect of bipolar IT and Pulsed US for soft tissue disorders Annals of the rheumatic diseases 1999 Sept; 58 (9): 530-40.	RCT 180 patients	Neither Interferential nor Ultra Sound prove to be effective as adjuvant to exercises therapy for soft tissue Shoulder Disorder	Good
5.	Johnson Mark I Mystique of	Description Of IFC by - De Domenico 1987 - Nikololova (1987)	Need to evaluate IFC Rx protocols Require a andomized placebo controlled clinical trial to Ix the effectiveness of IFC to	Poor

No	Author, Title, Journal, Year	Study design, Sample size, Follow up	Outcomes & characteristic	Grade & Comments
	Interferential Currents when used to manage Pain Physiotherapy 1999; 85(6):294-297	- savage (1992) Anectodal reports of IFC effectiveness	relieve pain. A RCT to compare the analgesic effectiveness of IFC with TENS Perhaps should not abandon the clinical use of IFC to manage pain as the modality could have potential benefits over other other electro-analgesic tech. Such as TENS	
<i>SAFETY</i>				
1.	Lambert I, Tebbs SE Interferential therapy machines as possible vehicles for cross infection. Journal of Hospital Infection 2000 Jan; 44 (1):59-64	Controlled trial study. 20 suction cups and sponges	Suction cups and sponges—contaminated with microorganism during treatment and have the potential to transfer microorganism from one to another if not disinfected adequately after use	Good

ULTRASOUND

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
1.	<p>Database of abstracts of reviews of effectiveness (University of York)</p> <p>Published trials of non medicinal and non invasive therapies for hip and knee</p> <p>Osteoarthritis recent update 30.6.98 Vol (1) Jan 2001</p>	<p>RCT</p> <p>74 patients examined ultrasound pre exercise diathermy</p>	<p>Available evidence suggest that diathermy provides no benefit in terms of pain reduction or improvement in function when added to an exercise program.</p>	<p>Good</p>
2.	<p>Database of abstracts of reviews of effectiveness (University of York)</p> <p>Physiotherapy for patients with soft tissue shoulder disorders: a systemic review of randomized clinical trials</p> <p>Recent update 30.6.98 Vol (1) Jan 2001</p>	<p>4 out of 6 trials were acceptable.</p>	<p>None showed evidence that U/S was more effective than cold therapy and steroid injection, non-steroidal anti inflammatory drugs and acupuncture, TENS, analgesics and iontophoresis or placebo .</p> <p>Conclusion U/S – ineffective. Low level laser/heat treatment/coldtherapy /electrotherapy /exercise and mobilization - inconclusive due to small trial sizes and unsatisfactory methods.</p>	<p>Good CRD Commentary-evidence in primary study is methodologically poor and further efforts are necessary to provide stronger evidence to back up the</p>

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
				conclusions of the reviewers
3.	<p>Database of abstracts of reviews of effectiveness (University of York)</p> <p>U/S therapy in musculoskeletal disorder: a meta analysis .</p> <p>Recent update 19.6.1996 Vol (1) Jan 21</p>	13 studies of the 16 identified were assessed compared U/S with sham U/S	<p>Results comparing U/S with sham U/S were not significant</p> <p>No cost information reported.</p>	<p>Good</p> <p>Unimportant effect of U/S</p> <p>Different diseases – problem with meta- analysis</p> <p>CRD</p> <p>commentary – Through review but in adequate information on various pain scale in primary studies given, need more info on primary studies and</p>

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
				statistical tech. Not clearly explained
4.	<p>Bouter LM</p> <p>Insufficient scientific evidence for efficacy of widely used electrotherapy, laser therapy and U/S treatment in physiotherapy</p> <p>Ned Tijdschr Geneeskd 2000 Mar 11; 144 (11):502-5</p>	<p>3 systemic reviews including 169 randomised clinical trials Assessed efficacy of electrotherapy, laser therapy and U/S treatment Published by Dutch Health Council</p>	<p>No conclusive clinically relevant effects of the 3 forms physical therapy were found. Possible exceptions U/S treatment for epicondylitis lateralis</p>	<p>Good</p> <p>Further research clearly indicated before implementation in practice is justifiable. Article in Dutch</p>
5.	<p>Falconer J, Hayesa KW</p> <p>Effect of U/S on mobility in OA of the knee. A randomised clinical trial</p> <p>Arthritis Care and research 1992 Mar, 5 (1) : 29 - 35</p>	<p>RCT</p> <p>Effectiveness in relieving stiffness and pain in OA pts .</p> <p>34 Exercise + U/S</p> <p>35- Exercise + sham U/S</p> <p>Assessed at baseline/ after treatment and 2 months later</p>	<p>No significant differences in improvements in ROM and pain were found between the 2 groups . Paired t test showed both groups significantly improved</p>	<p>Good</p>
6.	<p>Marks R, Ghanagaraja S, Ghassemi M</p>	<p>A Systemic Review Medline, Excerpt Medica and Cinahl database 1966 – 1999.</p>	<p>Efficacy of U/S as a treatment for knee OA was found in only one of the studies appraised but this incorporated a poor study design, rendering</p>	<p>Good</p>

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
	U/S for OA of the knee Physiotherapy Sept 2000 Vol 86	Manual search from 1950 5 English Publications A) Bansil and Joshi (1975) B) Esmat (1975) C) Svarcova <i>et al</i> , (1988) D) Jan and Lai (1991) Falconer (1992)	its results questionable. The remaining studies which found either equitable outcomes between Grps Rx with U/S or other modalities, or no benefit when compared with sham U/S, were similarly flawed. Further research studies using sound methodologies are needed to clarify whether U/S is useful or superior. Clear evidence of the	
7.	Ray Marks, Dean Cantin Symptomatic OA of the knee Physiotherapy June 1997 83 (6)	Uncontrolled retrospective and prospective . 26 pts - OA with out pts therapy, 6 mths F/U telephone survey on 14 who had received physio (combination - exs, ice, U/S, SWD, gait training, Interferential , education, laser, frictions.	Initial objective improvement in knee strength in 47% of cases, reduced knee pain 76%, improved knee ROM 53%. At 6 mths pts maintained improvement in stairs climbing, level walking and sit to stand activities.	Poor Physiotherapy modalities were mixed and results were as a group.U/S was not compared singly
8.	Hawkes <i>et al</i> , A comparison of 3 different physiotherapy treatment for RA of the hands Physiotherapy Practise, 1986' 2: 155-160	A) Grp 1: Exs & wax Grp 2: Exs & U/S Grp 3: Exs, U/S, faradic hand bath 30 pts were randomly allocated to one of these grps for 3 weeks	All showed improvement in grip strength, joint size, pain, articular index, ROM, timed task and a checklist of activities.	Poor No control Perhaps exercise a significant factor in bringing about some changes

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
9.	<p>Bromley <i>et al</i>,</p> <p>Changes in stiffness following short and long term application of standard physiotherapeutic techniques</p> <p>British journal of Rheumatology 1994; 33(6): 555-61</p>	<p>18 Ra pts stiffness parameter measured before and after each session</p> <p>10 pts : wax</p> <p>11 pts : U/S</p> <p>13 pts : wax follwed by U/S</p> <p>B) 6 pts : active/passive movt</p>	<p>Author concluded that none of the treatments considered caused a significant long term change in the joint stiffness parameters. The torque range and energy dissipation were reduced highly but temporary by single application of wax plus U/S</p>	<p>Poor</p> <p>Flawed poor study</p>
10.	<p>Jan MH, Lai JS</p> <p>The effect of Physiotherapy on OA knee of female</p> <p>J Formos Med Assoc 1991 Oct, 90(10): 1008-13</p>	<p>From feb 87 to Jan 89 collected 94 OA knees from 61 female pts & divided 4 grps</p> <p>Grp 1 U/S</p> <p>Grp 2 SWD</p> <p>Grp 3 U/S & Exs</p> <p>Grp 4 SWD & Exs</p> <p>were assessed functional incapacity scoring & isokinetic testing before and after Rx clinical trial ,controlled clinical trial</p>	<p>All pts had significant improvement in both functional capacity and peak torque</p>	<p>Good</p> <p>This study failed to prove any significant different in Rx effect between U/S and SWD for chronic OA knees.</p>

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
11.	<p>Kolchin IM <i>et al</i>, The treatment experience of RA patients in an industrial region of the donetss Basin</p> <p>Likarska Sprava 2000 Jul – Aug; 5:18 –20</p>	not stated	All pts had significant improvement in both functional capacity and peak torque	Combination therapy
12.	<p>Saveriano G <i>et al</i>,</p> <p>Our experience in the use of a new objective pain measuring system in rheumarthropatic subjects treated with transcutaneous electroanalgesia and U/S</p> <p>Minerva medica 1986 Apr 28; 77(18): 745-52</p>	assessed in a grp of 38 pts with degenerative skeletal pathologies and insertional tendinopathies - were treated with transcutaneous electroanalgesia and U/S	The best clinical response from TENS followed by U/S.	Poor
13.	<p>Krasil'nikov RG <i>et al</i>,</p> <p>A comparative assessment of the efficacy of thiophosphamide electrophoresis and U/S in the combined therapy</p>	Not stated	all pts had significant improvement in both functional capacity and peak torque	

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
	<p>of reactive</p> <p>Arthritis(Russian) Terapevticheskii Arkhiv 1991; 63(5): 72-5</p>			
14.	<p>Grigor'eva VD <i>et al</i>,</p> <p>The combined use of cryogenic exposure and U/S in patients with arthrosis of the joints of the legs (Russian)</p> <p>voprosy Kurortologii, Fzioterpii I Lechebnoi Fizicheskoi kultury 1996 Jan-Feb (1):18-21</p>	Not stated	all pts had significant improvement in both functional capacity and peak torque	combination therapy (Russian)
15.	<p>Yung P <i>et al</i>,</p> <p>Measurement of stiffness in the metacarpophalangeal joint: the effect of physiotherapy</p> <p>Clinical Physics & Physiological Measurement 1986 May ; 7(2): 147-56</p>	not stated	SWD and U/S both reduced the amount of energy dissipated in the joints of the patients.	

INFRARED

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
1	<p>Stelian J Gil I <i>et al</i>,</p> <p>Improvement of pain and disability in elderly patients with degenerative osteoarthritis of the knee treated with narrow - band light therapy</p> <p>Journal of the American Geriatrics Society 1992 Jan; 40(1):23-6</p>	<p>RCT</p> <p>50</p> <p>1 year</p> <p>Short-Form McGill Pain Questionnaire, Present Pain Intensity and Visual analogue Scale for pain and disability index</p> <p>Questionnaire for disability were used. We evaluated pain and disability before and on the tenth day of therapy</p> <p>The period from the end of the treatment until the patients request to be retreated was summed up 1 year after the trial</p>	<p>Pain and disability before treatment did not show statistically significant differences between the three groups. Pain reduction in the red and infrared groups after treatment was more than 50% in all scoring methods($P < 0.05$). There was no significant functional improvement in red and infrared treated group ($P < 0.05$) but not in the placebo group. The period from the end of treatment until the patients required treatment was longer for red and infrared groups than for the placebo group (4.2+/- 3.0, 6.1 +/- 3.2, and 0.53 +/- 0.62 months, for red infrared and placebo respectively)</p> <p>Conclusion: low power light therapy is effective in relieving pain and disability in degenerative Osteoarthritis of the knees</p>	Good
2	<p>Branco K & Naeser MA</p> <p>Carpal tunnel syndrome: clinical outcome after low -level laser, acupuncture, microamps transcutaneous electrical</p>	<p>Non-Randomsed Trial</p> <p>N=36</p> <p>F/up: 24 months</p> <p>Pre & post treatment</p>	<p>Post treatment. Pain significant reduced ($P < 0.0001$) and 33 of 36 hands (91.6%) no pain, or pain reduced by more than 50%. The 14 hands that failed surgical release successfully treated. Patients remained employed, if not retired. Follow up after 1-2 years with cases less than age 60, only 2 of 23 hands (8.3%) pain returned,</p>	Good

No	Author, Title, Journal, Year	Study Design, Sample size, Follow up	Outcomes & Characteristic	Grade & Comments
	nerve stimulation and other alternative therapies-an open protocol study	Melzack pain scores; profession & employment status reduced	but successfully retreated within a few weeks. Conclusion Possible mechanisms for effectiveness include increased adenosine triphosphate (ATP) on cellular level, decrease in serotonin. There are potential cost saving with this treatment (current estimated cost/case \$12,000; this treatment \$1,000). Safe when applied by licensed acupuncturist trained in laser acupuncture, supplemental home treatments may be perform by patient under supervision of acupuncturist	

HOT PACK

No	Author, Title, Journal, Year	Study design, Sample size, Follow up	Outcomes & Characteristics	Grade & Comments
1	Samborski W, Stratz T; Sobieska M; Mennet P, Muller W & Schulte Monting J Intraindividual comparison of whole body cold therapy & warm treatment with hot packs in generalized tendomyopathy Zeitschrift fur Rheumatologie 1992 Jan-	Cross over	Cold therapy showed significant improvement in pain assessment & visual analog scale except pain score values which decreased slightly with hot mud packs.	

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	Feb; 51(1):25-30			
2	<p>Milligan AJ</p> <p>Whole body hyperthermia induction technique</p> <p>Cancer Res 1984 Oct; 44 (10 suppl):4869-72</p>		<p><i>there is significant improvement after cold therapy after 2 hours and even at 24 hours. However the pain score values showed a slight decrease immediately after hot mud- pack application.(Milligan AJ, 1984).</i></p>	
3	<p>Oosterveld FG, Rsker JJ, Jacobs JW, Overmars HJ</p> <p>The effect of local heat and cold therapy on the intraarticular and skin surface temperature of the knee</p> <p>Arthritis Rheum 1992 Feb; 35(2): 146-51</p>	<p>Controlled Clinical Trial</p> <p>N= 42</p>	<p>The use of superficial heat packs in the treatment of patients with arthritis may potentially cause harm by increasing intraarticular temperature,</p>	

WAX

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1.	<p>Borrell RM, Parker R, Henley EJ, Masley D, Repineoz M</p> <p>Comparison of in vivo temperatures produced by hydrotherapy, paraffin, wax treatment, and fluidotherapy</p> <p>Physical Therapy 1980; 60(10):1273-6</p>	Not stated	<p>The effectiveness of a new heat modality, Fluidotherapy, was compared with other superficial heat modalities by in vivo temperature measurements. The joint capsule and muscle temperatures in the hands and feet were measured in subjects treated with hydrotherapy, paraffin wax and fluidotherapy. Fluidotherapy is dry heat modality consisting of finely divided solids suspended in an air stream. The dry heat modality, applied at 118⁰ F (47.7⁰ C), resulted in maximum joint capsule and muscle temperature rises of 16.2⁰ F (9⁰ C) and 9.5⁰ F (5.27⁰ C), respectively, compared to 13.5⁰ F (7.5⁰ C) and 8.1⁰ F (4.5⁰ C) for paraffin wax treatment and 10.8⁰ F (6.0⁰ C) and 7.7⁰ F (4.3⁰ C) for a 102⁰ F (38.89⁰ C) water bath, at a depth of about 0.5 cm beneath the skin.</p> <p>Conclusion: Paraffin was and other superficial heat modalities more effective than diathermy at depth up to 1.2 cm. Better than ultrasound at elevating temperature</p>	Good – Fair
2.	<p>Delhag B; Wollersjo I & Bjelle A</p> <p>Effect of active hand exercise and wax bath treatment in rheumatoid arthritis patients</p>	<p>RCT</p> <p>N=52</p> <p>F/up: 4 weeks</p>	<p>The control group was measured at corresponding times, wax bath treatment followed by active hand exercise resulted in significant improvements of range of motion (ROM) and grip function. Active hand exercise alone reduced stiffness and pain with nonresisted motion and increased ROM. Wax bath alone had</p>	Good - Fair

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	Arthritis Care & Research 1992 Jun; 5(2): 87-92		no significant effect.	
3.	<p>Bromley J, Unsworth A & Haslock I</p> <p>Changes in stiffness following short and long term application of standard physiotherapeutic techniques</p> <p>British Journal of Rheumatology 1994 Jun; 33 (6): 555-61</p>	6 weeks	Significant result only when the modalities were combined. However result was only temporary	
4.	<p>Yung P Unsworth A & Haslock I</p> <p>Measurement of stiffness in the meatacarpophalangeal joint: the effect of physiotherapy</p> <p>Clinical Physics & Physiological</p>	No stated	5 modalities of treatment perform. Short wave diathermy & ultrasound showed significant results in reduced the amount of energy dissipated in the joint of patients	

No	Author, Title, Journal, Year	Study Design, Sample Size Follow up	Outcomes & Characteristic	Grade & Comments
	Measurement 1986 May, 7: 147-56			
5.	Stewart M Researches into the effectiveness of physiotherapy in rheumatoid arthritis of the hand Physiotherapy 1996 Dec; 82(12):666-71		Wax bath alone does not appear to be effective in reducing pain or stiffness	

LASER

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
1.	Brosseau L <i>et al</i> , Low level laser Therapy (class 1, 11 & 111) in the treatment of Rheumatic Arthritis.	Meta-analysis 2 independent reviewer 5 placebo-controlled study included 204 patients included: 112 received laser Rx. Rx 2-3 sessions/week for	Assess on: pain, flexibility, stiffness, functional status, swelling, ROM, grip strength and walking speed. 3 trials used opposite limb as control 67 patients included; results were analysed separately. <u>Analysis of trials with separate control groups:</u> No significant heterogeneity for any comparisons,	Good

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
	Cochrane Database Syst. Rev 2000 (2) : CD 002049.	3-4 weeks except 1 study, for 3 times/week for 10 weeks. All RA involved fingers/thumbs except 1 study where joints not specified Only 2 trials follow-up pts for 3 mths after treatment completed.	<p>indicating the difference between treated & control groups was consistent across trials. In 3 trials, pain were reduced in treated group but not the placebo group (statistic significant). Also statistical significant in tip to palm flexibility and joint stiffness. The 2 trials follow-up pts found no significant. Significant difference between the LLLT and the placebo in any outcome measured.</p> <p><i>Analysis of contralateral control trials</i> <i>Improvement found in both laser & control treated hands.</i></p> <p><i>No difference between the laser & placebo for pain relief (odd ratio favoured laser).</i> <i>No difference in stiffness & swelling.</i> <i>This meta-analysis suggest that LLLT is effective at reducing pain in RA.</i></p> <p>Possible systemic effect of laser may be the key understanding to the improvement in pain scale with laser. Result suggest no long lasting effect. Summary: LLLT for RA beneficial in reduction of pain 7 morning stiffness but the outcome were in conflict. Conclusion: firm documentation of LLLT in RA is not possible. Special attention to low vs high dose, wave length, nerve vs joint application and treatment duration.</p>	

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
2.	<p data-bbox="296 383 609 594">Brosseau L <i>et al.</i>, Low level laser therapy (class I,11 &111)in the treatment of Osteoarthritis.</p> <p data-bbox="296 643 609 708">Cochrane Database Syst Rev 2000(2) CD 20046</p>	<p data-bbox="655 383 1012 708">Meta-analysis 2 independent reviewer Only controlled clinical trial included 5 trials were included. 112 patients received laser Rx. 85 patients received placebo.</p>	<p data-bbox="1037 383 1669 1399">2 trials used He-Ne laser of 632.8nm 1 trial used 904nm with a spacer laser 2 used Ga-As laser of 830nm wavelength 1 include OA of the thumb; 3 OA of the knee. 1 included OA of unspecified joints Assess: pain, pt-assessed global disease activity, medicine index, strength, joint mobility and tenderness Primary outcome of pain: no significant difference 1 triall reported significantly less pain in laser treated patient. 2 trials (oa of knee) show no difference in pain 1 trial found 4/5 pt in LLLT group reported pain relief compared to 0 out 3 in placebo group. 2 trial found no significance in patient assessed global disease activity with laser compared to placebo. There was a statistical improvement in the medicine index between laser and placebo treated patients. No statistical difference for any measures of strength, joint mobidity 7 tenderness. All studies score 3 or less out of 5 in quality assessment. Pooled effect on pain relief was non-significant but favour laser. This meta-analysis found that the pooled data</p>	Good

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
			<p>gave some evidence of clinical effect but the outcome were in conflict. Conclusion: there is insufficient evidence to draw any firm conclusion regarding the use of laser for the treatment of OA.</p>	
3.	<p>Hall J, <i>et al</i>, Low level laser Therapy is Ineffective in the management of Rheumatoid Arthritic Finger Joints . British Journal of Rheumatology 1994; 33:142-147.</p>	<p>Randomized, double-blind & placebo-controlled study. 40 patients with stage 11 or 111, according to Steinbocker <i>et al</i>., classification of definite RA . 20 nactive and 20 placebo Follow –up for 3 months.</p>	<p>The hand which the patients considered most affected was treated. Mostly dominant (active:55%, placebo:75%) Low power galium-aluminium-arsenide laser used. Patients treated 3x/week for 4 weeks. Wavelengths around 820nm have been recorded Measurements taken at pre-entry, post-treatment 1 month & 3 month follow-up. Measurements: Disease activity (duration of morning stiffness & Ritchie index); blood Ix (hb,plt count, CRP); Infra-red thermography of both hands (only collected in 3 occasions: pre, post & at 3 months f/up) Swelling of the PIP (arthrocircometer) &MCP(tape); Hand Strength, ROM (finger goniometer),Pain</p>	Good - Fair

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
			<p>(rest, activity and at night) using VAS;ADL measured by Health Assessment Questionnaire & arthritis specific scale.</p> <p>Results: pain during activity decreased significantly in both active (p=0.05) & placebo groups (p=0.01) at 3 month follow/up. Also on night pain improve in placebo group.</p> <p>No other significant difference.</p>	
4.	<p>Walker J</p> <p>Relief from Chronic Pain by Low Power Laser Irradiation.</p> <p>Neuroscience Letters, 43 (1983) 339-344.</p>	<p>Double blind RCT</p> <p>26 experimental subjects (5 OA; 6 sciatica; 9 trigeminal neuralgia; 5 post-hepatic neuralgia; 1 diabetic neuropathy</p> <p>10 control subjects (3 trigeminal neuralgia; 2 post-hepatic neuralgia; 3 OA; 2 sciatica)</p> <p>Treatment 3x/week for 10 weeks</p> <p>Follow-up: 6 months.</p>	<p>Helium-neon laser (632nm; 1mW, 20Hz) used</p> <p>Experimental subjects received laser over skin area overlying the radial, median, ulnar and saphenous nerve. Also received exposure to the painful nerve or joint.</p> <p>Control subjects received laser to areas of skin not innervated by these peripheral nerve, areas adjacent to the painful areas.</p> <p>24 hrs urine sample pre treatment and after 5-10 treatment for 5-HIAA level.</p> <p>Experimental subjects:</p> <p>OA: 4/5 experiencing pain relief</p> <p>Control subjects: OA: 0/3 experiencing pain relief</p> <p>Sciatica : 1/2 experiencing pain relief.</p> <p>Finding: Success rate by laser irradiation was superior to other afferent stimulation methods. Placebo response was essentially absent in controls. Six months follow-up of patients indicated pain-free without additional treatment.</p>	Good - Fair
5.	Beckerman Hospital, <i>et al</i> ,	Meta-analysis of RCT 36 RCT's involving	Computer searches (MEDLINE 1966-1990, EXERPTA MEDICA 1974-1990) for articles	Good

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
	<p>The efficacy of Laser Therapy for Musculoskeletal & Skin Disorders.</p> <p>A criteria-Based Meta-analysis of Randomized Clinical Trials Physical Therapy. 1992, 72:483-491.</p>	1704 patients.	<p>reporting the results of RCT's.</p> <p><u>Inclusion criteria</u> :study for the efficacy of laser therapy compared with the efficacy of placebo or other therapies; only RCT's; only patients with disorders of musculoskeletal system or skin disorders; outcome measured should be clinically important 2 independent reviewers, differences resolved by discussion and further clarification of the criteria. Only 7 of the 36 RCT's had 50% or more of the maximum methodological score/criteria. ie poor quality 3 studies->+ve results (favouring laser therapy) 2 studies->-ve results (no difference) 2 studies-> incorrect statistical analysis. Most observed no side effect. Others reported: Transient tingling, mild erythema, burning sensation, increased pain, numbness and skin rash.</p> <p>Conclusions: Majority showed major flaws in design Some better ones suggest that laser therapy is effective, especially for posttraumatic joint disorder, myofascial pain and rheumatoid arthritis.</p> <p>There is a need for further well designed RCT's to determine the efficacy of laser therapy.</p>	
6.	<p>Heussler JK,<i>et al</i>,</p> <p>A double Blind Randomised Trial of</p>	<p>Double blind RCT 25 patients: one hand treated, one hand received placebo</p>	<p>18/25 (72%) reported improvement in pain but in both hands (p<0.001). Analgesic unchanged Functional Hand Assessment: no significant difference; Lab and scan parameters: no</p>	Good - Fair

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
	<p>Low Power Laser Treatment in Rheumatoid Arthritis.</p> <p>Ann rheum Dis 1993; 52 : 703-706.</p>	<p>No follow-up after the 4 week period.</p>	<p>significant changes.</p>	
7.	<p>Lawrence, E, <i>et al</i>,</p> <p>Clinical Comparative Study of Micro-current Electrical stimulation to Mid-Laser & Placebo treatment in Degenerative Joint disease of the Temporo-mandibular Joint</p> <p>The Journal of Craniomandibular Practice 1995, (13); 2116-120.</p>	<p>RCT</p> <p>48 patients assigned into 3 groups; 16 patients per group.</p>	<p>Voluntary basis from patients referred for physical therapy for treatment of mandibular pain dysfunction.</p> <p>1. Radiological Dx; 2 C/o jt pain association with mandibular dysfunction; 3.Abnormal mandibular movement; 4.Anterior disk displacement without reduction.</p> <p>Grp 1: (MENS) 10 minutes, specific dosage, x3/week for 3 weeks.</p> <p>Grp 2: (mid-laser) with CAMBY 1 infrared laser with a 904nm wavelength, frequency 700Hz, apply for 9 minutes; x3/week for 3 weeks.</p> <p>Grp 3: (Placebo mid-laser)</p> <p>Measures total Vertical Opening (TVO) for each of the 9 sessions;</p> <p>Left and right lateral deviation (LD) on pre-and post-test period; pain Index on pre-and post-test.</p> <p>Results: MENS and mid-laser treatment produced significantly greater changes than did the placebo (p,0.01 & p<0.05); No significance btw Grp 1 and Grp 2 although Grp 2 appears</p>	<p>Good - Fair</p>

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
			better. Conclusion: MENS and mid-laser can be clinically utilized in the alleviation of pain with subsequent enhancement of joint mobility.	
8.	<p>Tam G</p> <p>Low Power Laser Therapy and Analgesic Action</p> <p>J Clin Laser Med Surg 1999 Feb; 17(1) 29-33</p>	<p>Non-controlled study 372 patients were treated</p>	<p>Laser has substantially reduced the symptoms as well as improved the quality of life of these patients, ultimately postponing the need for surgery.</p>	<p>Abstract</p>
9.	<p>Fulga C; Fulga IG; Predescu M</p> <p>Clinical study of the Effect of Laser therapy in Rheumatic Degenerative disease.</p> <p>Rom J Intern Med 1994 Jul-Sep; 32(3): 227-33</p>	<p>Uncontrolled study 136 patients were selected.</p>	<p>Patients unresponsive to or contra-indicated for NSAIDs were treated with 940-980nm wavelength laser daily for 10/7. Studies on pain, muscular contractor, local oedema and the impairment of articular mobility.</p> <p>Results: All patients presented a beneficial evolution OA of knee, ankle and shoulder evolved worse than painful back.</p> <p>Conclusions Laser Therapy can be beneficial in patients with rheumatic degenerative disease.</p>	
10.	<p>Fulga C</p> <p>Anti-inflammatory effect of the laser therapy in rheumatoid arthritis</p>	<p>Clinical trial 60 patients were treated.</p>	<p>The effect of a 940-980nm wavelength laser radiation on RA was analysed.</p> <p>60 patients: 44 adults and 16 children</p> <p>Each jt was daily treated by irradiation during 7 minutes for a period of 10 days.</p>	<p>Abstract</p>

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
	Rom J Intern Med 1998 Jul-Dec; 36(3-4);273-9.		Evolution was estimated using an analogic scale with 3 steps for 2 parameters: local pain & local inflammation for each treated jt. Evolution was favourable in both but inflammation seem better; better in children; aip, CM & shoulder jts better than knees. Serological data not affected. When relapse, treated joints were not affected again.	
11.	Bertolucci LE <i>et al</i> , Clinical Analysis of mid-laser vs Placebo Treatment of Arthralgic TMJ Degenerative Joints J Craniommandibular Practice 1995 Jan ,13 (1):26-9.	RCT 32 patients randomized to 2 grps.	Patients with 1. Radiological Dx of DJD,2. Subjective complaints of jt. Pain association with mandibular dysfn,3.Abn mandibular movements. 4.Ant disk displacement without reduction in 1 or both TMJs. Randomized to grp 1 placebo and grp 11 mid-laser Tx. Txx3/week for 3 weeks. Laser exposure for 9 min at 700Hz at 27 watts at 100% power output. Measures TMJ biomechanics⊗Total vertical opening & right & left Lateral deviation);Subjective pain reporting (VAS). Results: Mid-laser treatment provide greater pain reduction & improvement in TMJ biomechanics than placebo p<0.01.	
12	Bouter LM Insufficient scientific evidence for efficacy of widely used	Review	There is insufficient scientific evidence for the efficacy of laser therapy in physiotherapy with the possible exception of rheumatoid arthritis.	

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
	electrotherapy, laser therapy, and ultrasound treatment in physiotherapy Ned Tijdschr Geneeskd 2000 Mar 11; 144 (11):502-5			
<i>SAFETY</i>				
1	Bullow PM <i>et al</i> , Low power Ga-Al-As laser treatment of painful osteoarthritis of the knee : A double blind placebo controlled study Scand J Rehab Med 1994; 26: 155-159	Double blind Placebo controlled study 24 patients with OA	No side effect	Good - Fair
2	Basford JR <i>et al</i> , Low energy Helium Neon Laser Treatment of Thumb Osteoarthritis Arch Phys Med Rehabil 1987 Nov; 68(11): 794-7	RCT 81 patients 1-2 months after treatment completed question by phone	Minimal side effect 1 patient from each group	Good - Fair

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
3.	<p>Brosseau L <i>et al</i>,</p> <p>Low level laser therapy (Class I,II &III) in the treatment of Rheumatoid Arthritis</p> <p>Cohrance Database System Rev 2000 (2)</p>	<p>Meta analysis</p> <p>5 placebocontrolled study included 2204 patients includedonly 2 trail follow uo patients for 3 months after treatment completed</p>	<p>No adverse effect</p>	<p>Good</p>
4.	<p>Brosseau L <i>et al</i>,</p> <p>Low level laser therapy (Class i.II &III) in the treatment of Osteoarthritis</p> <p>Cohrance Database System Rev 2000 (2)</p>	<p>Meta analysis</p> <p>5 trial included</p> <p>112 patients received laser treatment</p> <p>85 patients received placebo</p>	<p>No side effect report</p>	<p>Good - Fair</p>
5.	<p>Fulga C; Fulga IG; Predescu M</p> <p>Clinical study of the Effect of Laser therapy in Rheumatic Degenerative disease.</p>	<p>Uncontrolled study</p> <p>136 patients were selected.</p>	<p>No side effect reported</p>	

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
	Rom J Intern Med 1994 Jul-Sep; 32(3): 227-33			
6.	Fulga C Anti-inflammatory effect of the laser therapy in rheumatoid arthritis Rom J Intern Med 1998 Jul-Dec; 36(3-4); 273-9.	Clinical trial 60 patients were treated.	No adverse effect observed	
7.	Beckerman H <i>et al</i> , The efficacy of Laser Therapy for Musculoskeletal & Skin Disorders. A criteria-Based Meta-analysis of Randomized Clinical Trials Physical Therapy. 1992, 72:483-491.	Meta-analysis of RCT 36 RCT's involving 1704 patients.	Only a few researcher have investigate the side effect; Most reported no side effect; other reported mild side effect; two report side effects in both treated and placebo groups	Good
8.	Heussler JK, <i>et al</i> , A double Blind Randomised Trial of Low Power Laser	Double blind RCT 25 patients: one hand treated, one hand received placebo No follow-up after the 4	No significant difference in side effect in both groups	Good - Fair

No.	Author Title Journal, Year	Study design Sample Size Follow-up	Outcome & Characteristic	Grade & Comments
	Treatment in Rheumatoid Arthritis. Ann rheum Dis 1993; 52 : 703-706.	week period.		
9.	Mark R & de Palma F Clinical efficacy of Low Power Laser Therapy in Osteoarthritis Physiother Res Int 1999; 4(2):141-57	Review	4 studies demonstrate positive treatment effect on Osteoarthritis. Thus, they concluded statistically superior results in laser treatment, although there is a caution on shortcomings in study designs.	

CORONA DISCHARGE DEVICE (SONOTRON)

No	Author, Title, Journal, Year	Study design, Sample size Follow up	Outcomes & Characteristic	Grade & Comments
1	Chiaki Walda, Tetsuo	Non controlled descriptive	70 % of patients has long duration of relief from	Poor

	<p>Muramatsu</p> <p>The Effect of Corona Discharge Therapy</p> <p>Physiotherapy 1995 Feb; 24 (4): 92</p>	<p>study</p> <p>488 patients</p>	<p>pain (average about a year) after stopping the therapy</p>	<p>causes of pain not specific in this study</p>
2	<p>Koji Sato, Tetsuo Muramatsu</p> <p>Measures for pain relief in Orthopedic Sureger. Corona Discharge Therapy for the Pain of the knee osteoarthritis</p> <p>Japan Journal Orthopaedic Surgery, 1995 Extra Issue No 27</p>	<p>Non-controlled descriptive study</p> <p>116 knee</p>	<p>Significant pain relief improved range of motion with Sonotron alone, without any other treatment</p> <p>No significant side effect noted on any patient</p>	<p>Poor</p>
3	<p>Greenberg LM</p> <p>The use pf sonotron in pain management</p> <p>http://www.wnkmarketing.com</p>	<p>Case Series</p> <p>N=4 patients</p> <p>F/up: 6 month</p>	<p>20 patient improve in pain</p>	
4	<p>Cohen L, Rodrifuez J, Holtz A Freeman K</p> <p>Treatmen of Joint infmmation & pain using</p>	<p>Case series</p> <p>N=73 patients</p>	<p>71 had some alleviation of pain</p> <p>56 had increase joint use</p>	

	Sonotron Http://www, wnmarketing.com			
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CAPSAICIN

No	Author, title, Journal, Year	Study design, Sample size & Follow up	Outcomes & Characteristics	Grade & Comments
<i>EFFECTIVENESS FOR RHEUMATOID ARTHRITIS</i>				
1	McCarthy GM, McCarty DJ Effect of topical capsaicin in the therapy of painful osteoarthritis of the hands J Rheumatol 1992 Apr; 19(4):604-7	RCT- Double blind 7 RA patients 40 joints treatment with caps 60 joints treatment with vehicle Placebo = vehicle for capsaicin	No difference in tenderness and pain in RA No effect on grip strength, duration of morning stiffness, function Local burning sensation was only adverse effect noted Conclusion Topical capsaicin is not an effective drug for the treatment of painful RA of the hands	Good – Fair Small sample Analysis by joints rather than patients
2	Deal CL <i>et al</i> , Treatment of arthritis with topical capsaicin : a double blind trial Clin Ther 1991 May-Jun;	RCT - Double blind, multi centre 31 RA cases & 70 OA cases 4 weeks	Significantly more relief of pain was reported by the capsaicin treated patients than the placebo patients throughout the study After four weeks of capsaicin treatment both RA & OA patients demonstrated statically significant reductions in pain	Good - Fair

No	Author, title, Journal, Year	Study design, Sample size & Follow up	Outcomes & Characteristics	Grade & Comments
	13(3):383-95		<p>80% Capsaicin treated patients experienced a reduction in pain after weeks of treatment</p> <p>Conclude that capsaicin cream is a safe and effective treatment for arthritis</p>	
3	<p>Putte DW, Griffin MR</p> <p>Published trials of nonmedicinal and noninvasive therapies for hip and knee osteoarthritis</p> <p>Ann Intern Med 1994 Jul 15; 121 (2):133-40</p>	Review	<p>Capsaicin reduce pain associated with knee osteoarthritis</p> <p>More data are needed to evaluate the role of topical capsaicin</p>	
4	<p>Rumsfield J west DP</p> <p>Topical capsaicin in dermatologic and peripheral pain disorder</p> <p>DICP 1991 Apr; 25(4):381-7</p>	Review	<p>Capsaicin indicated for temporary relief of neuralgia pain</p> <p>Further clinical studies are needed to establish the efficacy of topical capsaicin.</p>	
<i>SAFETY FOR RHEUMATOID ARTHRITIS</i>				
1	McCarthy GM, McCarty DJ	<p>RCT- Double blind</p> <p>7 RA patients</p> <p>40 joints treatment with</p>	Local burning sensation was only adverse effect noted	<p>Good – Fair</p> <p>Small sample</p> <p>Analysis by</p>

No	Author, title, Journal, Year	Study design, Sample size & Follow up	Outcomes & Characteristics	Grade & Comments
	Effect of topical capsaicin in the therapy of painful osteoarthritis of the hands J Rheumatol 1992 Apr; 19(4):604-7	caps 60 joints treatment with vehicle Placebo = vehicle for capsaicin		joints rather than patients
2	Deal CL <i>et al</i> , Treatment of arthritis with topical capsaicin : a double blind trial Clin Ther 1991 May-Jun; 13(3):383-95	RCT - Double blind, multi centre 31 RA cases & 70 OA cases 4 weeks	Transient burning was felt at the side of drug application Conclude that capsaicin cream is a safe and effective treatment for arthritis	Good – Fair
<i>EFFECTIVENESS FOR OSTEOARTHRITIS ARTHRITIS</i>				
1	Towheed TE, Hochberg MC A systematic review of randomized controlled trials of pharmacological therapy in osteoarthritis of the knee, with an emphasis on trial methodology Semin Arthritis Rheum	80 RCTs (45 involved NSAIDs, 3 analgesics, 5 intraarticular (IA) steroids, 9 biological agents including IA hyaluronic and 18 mixed modalities including topical capsaicin	Data support use of topical capsaicin in the treatment of patients with knee OA	Good – Fair

No	Author, title, Journal, Year	Study design, Sample size & Follow up	Outcomes & Characteristics	Grade & Comments
	1997 Apr; 26(5):755-70			
2	Rosenstein ED Topical agents in the treatment of rheumatic disorders Rheum Dis Clin North Am 1999 Nov; 25(4):899-918	Review	Topical capsaicin offers potentially beneficial therapy for the treatment of osteoarthritis of selected joint	Poor
3	Wollheim FA Current pharmacological treatment of osteoarthritis Drugs 1996 52 Suppl 3: 27-38	Review	Capsaicin have some merit	Poor
4	Rains C, Bryson HM Topical caopsaicin: a review of its pharmacological properties and therapeutic potential in post-herpetic neuralgia, daibetic neuropathy and osteoarthritis Drug Aging 1995 Oct; 7	Rview Clical studies	Capsaicin merits consideration as adjuvant therapy in OA, diabetic neuropathy	Poor

No	Author, title, Journal, Year	Study design, Sample size & Follow up	Outcomes & Characteristics	Grade & Comments
	(4): 317-28			
5	<p>McCarthy GM, McCarty DJ</p> <p>Effect of topical capsaicin in the therapy of painful osteoarthritis of the hands</p> <p>J Rheumatol 1992 Apr; 19(4):604-7</p>	<p>RCT- Double blind</p> <p>14 OA patients</p> <p>135 joints treatment with caps</p> <p>132 joints treatment with vehicle</p> <p>Placebo = vehicle for capsaicin</p> <p>4 weeks</p>	<p>Capsaicin reduce tenderness and pain in OA, significant difference from placebo at 4 week</p> <p>Pain assessed by visual analog scale improved but not when assessed by categorical scale</p> <p>No effect on grip strength, duration of morning stiffness, function</p> <p>Local burning sensation was only adverse effect noted</p> <p>Conclusion</p> <p>Topical capsaicin is a safe and potentially useful drug for treatment of painful OA of the hands</p>	<p>Good – Fair</p> <p>Small sample</p> <p>Analysis by joints rather than patients</p>
6.	<p>Deal CL <i>et al</i>,</p> <p>Treatment of arthritis with topical capsaicin : a double blind trial</p> <p>Clin Ther 1991 May-Jun; 13(3):383-95</p>	<p>RCT - Double blind, multi centre</p> <p>31 RA cases & 70 OA cases</p> <p>4 weeks</p>	<p>Significant more relief of pain was reported by the capsaicin treated patients than the placebo patients</p> <p>Capsaicin demonstrated superior to placebo after 2 weeks treatment</p> <p>Relief maintained for 4 weeks</p> <p>Transient burning was felt at the sites of drug application</p> <p>Conclude that capsaicin cream is a safe and effective treatment for arthritis</p>	<p>Good - Fair</p>

No	Author, title, Journal, Year	Study design, Sample size & Follow up	Outcomes & Characteristics	Grade & Comments
7.	Nocholas JJ Physical modalities in rheumatological rehabilitation Arch Phys Med Rehabil 1994 Sep; 75(9):994-1001	Review	Literature reviewed suggested Capsaicin can provide pain relief in osteoarthritis if it is possible to deliver the treatment fully and persistently.	Poor
8.	Zhang WY; Li Wan Po A The effectiveness of topically applied capsaicin : A meta analysis. Eur J Clin Pharmacol 1994; 46(6):517-22	Meta-analysis of RCTs	Capsaicin cream is better than placebo in providing pain relief in osteoarthritis; OR =2.80 (95% CI= 2.77, 6.88) and RD = 0.29 (95% CI =0.20 , 0.37) Initial discomfort associated with topical capsaicin	
<i>SAFETY</i>				
1	McCarthy GM, McCarty DJ Effect of topical capsaicin in the therapy of painful osteoarthritis of the hands J Rheumatol 1992 Apr; 19(4):604-7	RCT- Double blind 14 OA patients	Local burning sensation was only adverse effect noted Conclusion Topical capsaicin is a safe and potentially useful drug for treatment of painful OA of the hands	Good – Fair Small sample Analysis by joints rather than patients

No	Author, title, Journal, Year	Study design, Sample size & Follow up	Outcomes & Characteristics	Grade & Comments
2	<p>Rains C, Bryson HM</p> <p>Topical capsaicin: a review of its pharmacological properties and therapeutic potential in post-herpetic neuralgia, diabetic neuropathy and osteoarthritis</p> <p>Drug Aging 1995 Oct; 7 (4): 317-28</p>	<p>Review Clinical studies</p>	<p>No severe systemic adverse effect however stinging and burning particularly during the first week of therapy</p>	<p>Poor</p>
3	<p>McCarthy GM, McCarty DJ</p> <p>Effect of topical capsaicin in the therapy of painful osteoarthritis of the hands</p> <p>J Rheumatol 1992 Apr; 19(4):604-7</p>	<p>RCT- Double blind</p> <p>14 OA patients</p> <p>135 joints treatment with caps</p> <p>132 joints treatment with vehicle</p> <p>Placebo = vehicle for capsaicin</p> <p>4 weeks</p>	<p>Local burning sensation was only adverse effect noted</p> <p>Conclusion Topical capsaicin is a safe and potentially useful drug for treatment of painful OA of the hands</p>	<p>Good – Fair</p> <p>Small sample Analysis by joints rather than patients</p>
4	<p>Deal CL <i>et al</i>,</p>	<p>RCT - Double blind, multi centre</p>	<p>Significant more relief of pain was reported by the capsaicin treated patients than the placebo</p>	<p>Good - Fair</p>

No	Author, title, Journal, Year	Study design, Sample size & Follow up	Outcomes & Characteristics	Grade & Comments
	<p>Treatment of arthritis with topical capsaicin : a double blind trial Clin Ther 1991 May-Jun; 13(3):383-95</p>	<p>31 RA cases & 70 OA cases 4 weeks</p>	<p>patients Capsaicin demonstrated superior to placebo after 2 weeks treatment Relief maintained for 4 weeks Transient burning was felt at the sites of drug application Conclude that capsaicin cream is a safe and effective treatment for arthritis</p>	
5	<p>Zhang WY; Li Wan Po A The effectiveness of topically applied capsaicin : A meta analysis. Eur J Clin Pharmacol 1994; 46(6): 517-22</p>	<p>Meta-analysis of RCTs</p>	<p>Initial discomfort associated with topical capsaicin</p>	<p>Good - Fair</p>

LEVELS OF EVIDENCE SCALE

Level	Strength of Evidence	Study Design
1	Good	Meta-analysis of RCT, Systematic reviews.
2	Good	Large sample of RCT
3	Good to fair	Small sample of RCT
4		Non-randomised controlled prospective trial
5	Fair	Non-randomised controlled prospective trial with historical control
6	Fair	Cohort studies
7	Poor	Case-control studies
8	Poor	Non-controlled clinical series, descriptive studies multi-centre
9	Poor	Expert committees, consensus, case reports, anecdotes

SOURCE: ADAPTED FROM CATALONIAN AGENCY FOR HEALTH TECHNOLOGY ASSESSMENT (CAHTA), SPAIN

THE FOLLOWING HTA REPORTS ARE AVAILABLE ON REQUEST:

<i>REPORT</i>	<i>YEAR</i>
1. LOW TEMPERATURE STERILISATION	1998
2. DRY CHEMISTRY	1998
3. DRY LASER IMAGE PROCESSING	1998
4. ROUTINE SKULL RADIOGRAPHS IN HEAD INJURY PATIENTS	2002 2002
5. STROKE REHABILITATION	
6. MEDICAL MANAGEMENT OF SYMPTOMATIC BENIGN PROSTATIC HYPERPLASIA	2002 2002
7. CHILDHOOD IMMUNISATION	2002
8. ROUTINE NEONATAL VITAMIN K ADMINISTRATION AT BIRTH	2002 2002
9. MANAGEMENT OF NEONATAL HYPERBILIRUBINEMIA	2002
10. SCREENING OF DIABETIC RETINOPATHY	
11. HOME VISITING	2002
12. ROUTINE CHEST RADIOGRAPHS IN ROUTINE MEDICAL EXAMINATIONS	2002
13. HOME NURSING	2002
14. HEAT TREATMENT FOR DEGENERATIVE CHANGES IN SKELETAL SYSTEM	