THE ROLE OF ESSENTIAL OILS IN THE MANAGEMENT OF MECHANICAL LOW BACK PAIN

By
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This dissertation represents my own work, both in conception and execution

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Approved for final submission

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I would also like to thank Mr. L. Yendall for his assistance, as well as my family, friends and colleagues for their encouragement and support.
The purpose of this study was to investigate the effects of essential oils, applied by means of effleurage massage, in the treatment of mechanical low back pain, in terms of the patient's physical and psychological responses to the essential oils, in order to determine the role of essential oils in the management of mechanical low back pain.

The sample size consisted of 20 patients with mechanical low back pain, and were randomly divided into a control and experimental group. The patients were treated over 30 days, with 8 treatments in total. The control group received effleurage massage with the carrier oil (almond oil), and the experimental group received application of the essential oils (chamomile and lavender) added to the carrier oil (almond oil). One week after the final treatment, the patients were re-evaluated. Outcome measures included the recording of the patients' general well-being (by means of the General Well-being Schedule) only at the initial consultation and the final consultation. Before each treatment, the patients were required to complete the Numerical Pain Rating Scale to subjectively determine the patients' perception of pain, and the researcher recorded the patients' dorsolumbar range of motion by means of a goniometer, to objectively determine the total impairment of whole man. The results were analysed statistically within each group, as well as between the two groups, by means of the Wilcoxon Signed Rank Test and the Mann-Whitney U-test, each at a significance level of 5%.

As regards pain, both groups showed a significant decrease in pain between treatment 1 and treatment 8, with a maintenance of the significant decrease between treatment 8 and the final consultation. No significant difference was noted between the two groups.

As regards total impairment of whole man, the control group did not display a significant decrease between treatment 1 and treatment 8, whereas the experimental group did. The experimental group also displayed a maintenance of this significant decrease between treatment 8 and the final re-evaluation consultation. The experimental group, however did not have a significant difference between the final re-evaluation consultation and treatment 1 (P = 0.050), so indicating with the number of negative differences outweighing the number of positive differences, that the total impairment of whole man is on the border of swinging back to what it was before treatment commenced.

With regard to pain levels, both groups responded favourably. With regard to total impairment of whole man, the control group did not respond favourably, whereas the experimental group did.

Effleurage massage of patients suffering from mechanical low back pain, is significantly beneficial in the management of these patients, in terms of the patients pain levels. Effleurage massage of patients suffering from mechanical low back pain, with the essential oils of chamomile and lavender, added to almond oil, is beneficial in the management of these patients, in terms of the decrease in the total impairment of whole man and the decrease in the patients' pain levels.
UITREKSEL

Die doel van hierdie studie was om onderzoek in te stel na die uitwerking van vlugtige olies wat aangewend is met behulp van effleurasiemassering vir die behandeling van meganiëse onderrugpyn, gemeet aan die pasiënt se fisiese en psigiese reaksie op die vlugtige olies, om te bepaal watter rol vlugtige olies in die behandeling van meganiëse onderrugpyn speel.

Die steekproef het bestaan uit 20 pasiënte met meganiëse onderrugpyn. Die pasiënte is luikraak ingedeel in 'n kontrolegroep en proefgroep. Die pasiënte is behandeloor 'n tydperk van 30 dae, met agt behandelings altesaam. Die kontrolegroep het effleurasiemassering met die draerolie (amandelolie) ontvang, terwyl vlugtige olies (kamille en laventel) wat by die draerolie (amandelolie) gevoeg is, op die proefgroep aangewend is. Die pasiënte is 'n week na die laaste behandeling weer geëvalueer. Die resultate wat gemeet is, het die aanteken van die pasiënt se fisiese en psigiese reaksie ingesluit. Die resultate is statisties met behulp van die Wilcoxon-Gerigte-Rangordetoets en die Mann-Whitney-U-toets ontleed, elk met 'n betekenisvlak van 5%.

Wat pyn betref, het albei groepe 'n noemenswaardig afname in pyn vanaf behandeling 1 tot behandeling 8 ondervind. Geen noemenswaardige verschil tussen die twee groepe is gemerk nie.

Wat die totale verswakking van die persoon in die geheel betref, het die kontrolegroep nie 'n noemenswaardige afname vanaf behandeling 1 to behandeling 8 ondervind nie, terwyl dit in 'n mate by die proefgroep afgeneem het. Hierdie noemenswaardige afname vanaf behandeling 8 tot die laaste her-evalueringskonsultasie is ook gehandhaaf by die proefgroep. By die proefgroep was daar nie 'n noemenswaardige verskil tussen die laaste her-evalueringskonsultasie en behandeling 1 nie (P = 0.050), en dat die getal negatiewe verskille die getal positiewe verskille oortref het, dui daarop aan dat die totale aantasting op die rand was om terug te swaai na wat dit was voordat behandeling 'n aanvang geneem het.

Wat pynvlakke betref, het albei groepe gunstig gereageer. Wat die totale veswakking van die persoon in die geheel betref, het die kontrolegroep nie gunstig gereageer nie. Die proefgroep daarenteen, het wel gunstig gereageer.

Wat die pasiënte se pynvlakke betref, is effleurasiemassering van pasiënte wat las het van meganiëse onderrugpyn baie voordelig vir die behandeling van hierdie pasiënte. Effleurasiemassering van pasiënte wat las het van onderrugpyn, met behulp van vlugtige olies (kamille en laventel) wat by amandelolie gevoeg is, is voordelig vir die behandeling van hierdie pasiënte, nie met wat die afname in die totale verswakking van die persoon in die geheel betref nie, maar ook wat die afname in die pasiënte se pynvlak betref.
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CHAPTER ONE
THE PROBLEM AND ITS SETTING

1.1 STATEMENT OF THE PROBLEM

This controlled study proposes to investigate the effects of essential oils, applied by means of effleurage massage, in the treatment of mechanical low back pain, in terms of the patient's physical and psychological responses to the essential oils, in order to determine the role of essential oils in the management of mechanical low back pain.

1.2 SUBPROBLEMS

1.2.1 The First Subproblem
The first subproblem is to evaluate the effects of essential oils, applied by means of effleurage massage, in terms of the patient's physical response to the treatment, in order to determine the physical changes that may occur, in the use of essential oils in the management of mechanical low back pain.

1.2.2 The Second Subproblem
The second subproblem is to evaluate the effects of essential oils, applied by means of effleurage massage, in terms of the patient's psychological response to the treatment, in order to determine the psychological changes that may occur, in the use of essential oils in the management of mechanical low back pain.
1.2.3 The Third Subproblem

The third subproblem is to integrate the patient's physical and psychological responses to essential oils, applied by means of effleurage massage, in order to determine the role of essential oils in the management of mechanical low back pain.

1.3 HYPOTHESES

1.3.1 The First Hypothesis

It is hypothesized that the use of essential oils in the treatment of mechanical low back pain will result in a reduction in the patient's perception of pain, as well as an increase in the patient's range of motion.

1.3.2 The Second Hypothesis

It is hypothesized that the use of essential oils in the treatment of mechanical low back pain will result in an increased level of the patient's perception of well-being.

1.3.3 The Third Hypothesis

It is hypothesized that the favorable physical and psychological effects of essential oils in the treatment of mechanical low back pain, will demonstrate the efficacy of the use of essential oils in the management of mechanical low back pain.

1.3.4 The Fourth Hypothesis

It is hypothesized that the carrier oils used in this controlled study will have no significant physical or psychological effects.
1.4 DELIMITATIONS

- Patients suffering from conditions other than mechanical low back pain, the symptomatology of which could include back pain, will be excluded from this study.

- Patients who present with neurological involvement, acute inflammatory reaction or muscle guarding, will be excluded from the study.

- Patients who have had spinal surgery will be excluded from the study.

- Patients who show contraindications to any of the essential oils to be used in this study, will be excluded from the study.

- Patients who are under the age of fourteen will not be considered for the study.

1.5 ASSUMPTIONS

- The patient's recovery rate is due to the effects of the essential oils, and not due to the natural history of the patient's condition.

- The patient is compliant with any instructions, given by the practitioner.

- The patient's occupation will not be considered as having an influence on the patient's response to the
treatment received.

Carrier oils have no physical or psychological effects in the treatment of mechanical low back pain.

1.6 DEFINITIONS

ESSENTIAL OIL
An essential oil is any of various volatile oils in plants, having the odour and flavour of the plant from which they are derived.

EFFLEURAGE MASSAGE
Effleurage massage is massage using stroking superficial movements.

MECHANICAL BACK PAIN
Mechanical back pain, is back pain not due to organic causes, but is associated with degenerative changes of the spine, as defined by Kirkaldy-Willis (1988).

PHYSICAL RESPONSE
The physical response is the patient's dorsolumbar range of motion and the patient's perception of pain.

PSYCHOLOGICAL RESPONSE
The psychological response is the patient's level of general well-being.
TREATMENT
Treatment is the application of essential oils, in a carrier oil, by means of effleurage massage, or in the case of the control group, it is the application of the carrier oil only, by means of effleurage massage.

MANAGEMENT
Management includes those treatment protocols and patient education approaches to each individual health discipline in the treatment of mechanical low back pain.

CONTROLLED STUDY
A controlled study is a study which has a control group and an experimental group, and for the purpose of this study, the control group will receive effleurage massage with the carrier oil only, and the experimental group will receive effleurage massage with the carrier oil containing essential oils.

CARRIER OIL
A carrier oil is an oil which is used as a base to which the essential oils are added.
1.7 IMPORTANCE OF THE STUDY

1.7.1 Background Of The Problem
Many forms of pain control, such as electrotherapy modalities and acupuncture, are available to the physical therapist in the treatment of mechanical low back pain. These forms of pain control have a purely physical effect on the patient. Specific essential oils, used in aromatherapy, have analgesic properties, as well as beneficial psychological effects, but their effects on mechanical low back pain, as well as their role in the management of mechanical low back pain, has not been researched. (see Appendix A and Appendix B)

1.7.2 Need For A Solution To The Problem
The role of essential oils in the management of mechanical low back pain has not been researched. As essential oils not only have a physical effect, but also a beneficial psychological effect, they could be of value as an adjunctive form of pain control, especially in cases where patients react adversely to other forms of pain control.

1.7.3 Description Of The Solution
This study proposes to investigate the use of essential oils in the management of mechanical low back pain, by application of effleurage massage, as there are specific essential oils which have analgesic properties as well as psychological properties. The patient is to be assessed in terms of their subjective perception of pain and general well-being, as well as the objective measurement of their dorsolumbar range of motion. Included in this study will be a control group,
which will not be exposed to essential oils at all, but to the base oil applied by effleurage massage. Essential oils are relatively inexpensive, and readily available to the public.

1.7.4 Benefits
The use of essential oils, not only addresses pain relief, but also the psychological well-being of the patient. This is an advantage over other forms of pain control, which do not have psychological effects. A reduction in pain, an increase in the range of motion, as well as the beneficial psychological effects, will contribute to the patients recovery rate and their sense of well-being, and so giving the management of mechanical low back pain a wider approach. Furthermore, the reduction in pain and increased range of motion, with a faster recovery rate, will decrease the treatment costs, as treatment would be of shorter duration, and decrease the number of manhours lost due to mechanical low back pain. Patient's are also able to administer the essential oils at home, thus there being self therapy.

1.7.5 Feasibility Of The Solution
- essential oils are relatively inexpensive, readily available to the public, and easily applied by both the physician and the patient
- the chiropractic day clinic where this study is to be conducted, is on the Berea campus of Technikon Natal
- the patients may be students, staff or outsiders
Chiropractor's employed by the Technikon, will be there to supervise the treatment applied.

The Beauty Technology department is on campus, and teach aromatherapy, and are able to help in supplying the essential oils, as well as being able to give any assistance that may be needed.
2.1 PAIN

Lehman et al (1986), state that low back pain is one of the most common ailments in Western Society, and that 80% of all adults have significant back pain during their lifetime. Low back pain is one of the most costly ailments to society in terms of medical expenses and lost worktime.

A summary of studies, concerning the conditions seen by chiropractors, shows that 68% of all patients have spinal problems, and 35% of these suffer from low back pain. (Manipulative Therapeutics lecture to 4th year chiropractic students, 1992, by Dr. A.G. Till).

Pain is difficult to define, and the usual response to that issue, is to use a synonymous term such as hurt or unpleasant sensation. A basic factor in the development of pain is when tissue integrity is threatened. Individual sensitivity to pain varies strikingly, and variations in tolerance to pain are not only a matter of different sensory thresholds but are at least partly related to emotional attitudes. The areas of the brain especially involved in the elaboration of emotions are the limbic lobe and considerable extents of the frontal cortex (Frederick and Kerr, 1981).

A well-known mechanism in the production of pain is the tension pain mechanism. If muscles are exercised in the absence of adequate circulation, they will give rise to discomfort and even very severe pain. The common hypothesis is that inadequate removal of waste products from the tissues provides noxious stimulation which is painful. Unaccustomed exercise of almost any bodily part,
especially under conditions of emotional tension, may give rise to pain which is attributable to muscle contraction (Merskey, 1984).

Ian McDowell and Claire Newell (1987), have shown that pain is a private and internal sensation that cannot be directly observed or measured, but whose measurement depends wholly on the subjective response of the person experiencing it. The measurement represents a blend of the strength of the underlying pain and of the person's emotional response to it. The way in which pain is reported, is influenced by many factors:

i) Biologically, there is a linear relationship between pain and extent of tissue damage - minor damage may give rise to intense pain, and vice versa.

ii) Some of the cultural factors are: sex, upbringing, personality and age.

The Collins Concise Dictionary Plus (1991), defines pain as the sensation of acute physical hurt or discomfort caused by injury, and illness.

Pain impulses may refer locally to perpetuate muscle spasm. While the primary function of muscles is to produce movement, muscles can also effectively restrict motion. Muscle spasm is universally acknowledged as a factor in the genesis of back pain. Range of motion is considered as the range of translation and rotation of a joint for each of its six degrees of freedom. With range of motion testing, the patient is asked only to go as far as pain will allow. Inferences may be drawn about limits from the pain of stretching injured muscles on limits imposed by joint locking. The more serious the injury, the greater the limitation imposed on motion. Muscle spasm that accompanies simple articular blockage is commonly due to
protective muscle splinting, which reflexly protects joints adjacent to the locked joints when they are required to provide compensatory mobility for the blocked articulation. Spinal movements are limited in direct proportion to the amount of spasm present (Gatterman, 1990).

2.2 MECHANICAL BACK PAIN

Mechanical back pain, is back pain not due to organic causes, but is associated with degenerative changes of the spine, as defined by Kirkaldy-Willis (1988), and he describes the following diagnostic classification:

1. The facet syndrome
2. The sacro-iliac syndrome
3. Maigne's syndrome
4. Disc herniation
5. Lateral stenosis
6. Central stenosis
7. Myofascial pain syndromes: - Gluteus medius
   - Gluteus maximus
   - Piriformis
   - Tensor fascia latae
   - Quadratus lumborum

Gatterman (1990) also classifies facet joint fixation in the dorsolumbar spine, as mechanical back pain. According to her, acute lumbar strain, which is the most common diagnosis for low back pain, involves stretching and tearing of spinal muscles and their attachments, resulting from muscle contraction associated with
uncontrolled movement or direct trauma to the back. Minor muscle strain can occur with overuse following unaccustomed repetitive tasks. This results in low back pain and stiffness, through the increased demands of muscle activity. Acute lumbar strain progresses to chronicity with repeated episodes of partial tears of spinal muscles and their attachments. With time the pathological changes of degenerative joint disease begin to complicate the low back dysfunction.

Disability in low-back pain can be understood in terms of physical impairment, psychological distress, and illness behavior (Waddell et al, 1984).

2.3 THE PSYCHOLOGY OF PAIN

Kirkaldy-Willis (1988) describes in the pathogenesis of mechanical back pain various contributing emotional disturbances, namely: tension, anxiety, uncertainty, depression, stress, fear and resentment. Price (1987) also comments about how the mind can affect the state of the body and various other authors also comment on the emotions that may accompany pain:

McDowell and Newell (1987) report that anxiety and fear, may often accompany pain.


Oostdam and Duivenvoorden (1987) found a relationship between psychological factors and the duration of back pain.
Egan and Betrus (1987) acknowledged psychological distress amongst individuals suffering from chronic pain syndromes. Krishnan and France (1987) established that patients with chronic pain syndromes often have concomitant depression. When chronic pain, i.e. pain occurring for more than six months, is the major complaint, then depression is found in 10% to 80% of patients. In most patients the pain precedes the depression, with the onset of depression often being as long as one to two years after the onset of pain. Sternbach (1977) describes anxiety as accompanying acute pain, and depression as accompanying chronic pain.

Goldstein (1986) maintains that pain is rarely all in the mind than in the body, but rather a byproduct of a rich interaction of the two. Emotional disturbances and marital disturbances were even found in spouses of chronic low back pain patients (Ahern, Adams and Follick 1985).

From the above reviewed literature, it is apparent that there is a correlation between pain and psychological distress.

According to McDowell and Newell (1987), treatment for pain should reflect the multiple influences (biological, social and psychological) on the pain experience.

2.4 TREATMENT OF MECHANICAL LOW BACK PAIN

The treatment modalities available to the chiropractor for the auxiliary treatment of mechanical back pain, include a host of physiological therapeutics, such as heat, cryotherapy, electrotherapy,
meridian therapy, ultrasound and spinal traction. These modalities serve to control pain and enhance healing, however no psychological benefits/effects have been reported for these modalities (Gatterman, 1990).

The purpose of treatment in acute lumbar strain, is to remove the stimulus for muscle spasm, and the patient should be palpated for facet joint locking, and manipulation should be appropriately applied. Physical therapy including ice and ultrasound reduces the pain and muscle spasm. Treatment of chronic lumbar strain must be directed to the involved muscles. The involved muscles respond to ultrasound, deep tissue massage and exercise. Manipulation of locked joints should not be used routinely to reduce reflex muscle spasm. Anything that interferes with the physiological relaxation of muscle will start a vicious cycle of spasm-pain-spasm (Gatterman, 1990).

Massage is indeed indicated to relieve certain kinds of pain. The effects of massage are not only psychological and reflexive in nature. Massage stimulates the exteroceptors of the skin and proprioceptive receptors of the underlying tissues as well as finger pressure to the acupuncture points. Relief of pain is brought about through any one of these effects, or by a combination of any of them. Mechanically, massage assists the venous flow of blood, encourages lymphatic flow, reduces certain types of oedema, provides gentle stretching of tissue and relieves subcutaneous scar tissue (Tappan, 1984).

According to MacNish, touch provides an astonishing amount of pain relief, and massage is one way of stimulating the large diameter (non-pain) nerve fibres, which close the pain gate, and so altering or
blocking pain signals.

Essential oils have been reported to have psychological as well as physical effects, but according to David Tagg (personal communication, 1992; Appendix A) and Robert Tisserand (personal communication, 1992; Appendix B), there is no information available on essential oils for musculoskeletal dysfunction of any kind, though information on the psychological effects of essential oils is vast.

2.5 ESSENTIAL OILS

2.5.1 Introduction

An essential oil is any of the various volatile oils in plants (Collin's Concise Dictionary Plus, 1989), and are also known as the hormones of plants (Price, 1987). Essential oils act upon the mind and body, and when they affect the mind, they have a spill-over effect to the body, as the limbic system has an interaction with the hypothalamus, which in turn can govern bodily functions (Beard, Aromatherapy Aide Memoire Series Number 1).

Essential oils are non-invasive to the human body as they are made of the same material, as the the aromatic chemicals found in essential oils are derived from phenylpropane, and these are the precursors of amino-acids, which link to make the proteins which provide the building blocks for just about anything in the human body from the smallest enzyme to the skeleton (Valerie Ann Worwood, 1990).

The knowledge of essential oils, and the use thereof on the body, dates back at least 2000 years before Christ, and even the Bible records the use of plant oils in the treatment of illnesses (Price,
1987). Also, the Egyptians, Chinese, Greeks and Romans made extensive use of the essential oils, and eventually the idea spread to Britain. Today the use of essential oils is known worldwide, and many books based on experience and case histories, have been written on their uses and application.

2.5.2 Extracting Essential Oils

Essential oils are extracted from certain varieties of trees, shrubs, herbs, grasses and flowers, and depending on the plant, the essential oil is stored in specialised oil or resin cells, glandular hairs, cells or scales which have single or multi-cell pockets or tiny reservoirs, either in the roots, stems, barks, leaves and/or flowers in varying quantities.

Various methods are employed to extract the oil from the plant, depending on the particular species. The most common method is steam distillation, although other important methods are solvent extraction, expression, enfleurage and maceration. Newer methods are presently being devised.

On average, an essential oil contains one hundred components - mainly - terpenes, alcohols, esters, aldehydes, ketones and phenols. A chemist is able to break the oils down into these components, but aromatherapists use them in their natural “mixed” state (when they are called terpenoids, because terpenes are present in the greatest quantity) (Price, 1987, Worwood, 1990).

2.5.3 Essential Oils And Back Pain

Approximately 300 essential oils are used today by professional practitioners, each having its own medicinal and other properties
For the purpose of this project the following two essential oils were chosen:

- chamomile
- lavender

Chamomile and lavender blend well together, thus having a synergistic action (Sellar, 1992). The anti-inflammatory action of chamomile essential oil is greatly increased by adding lavender essential oil in the correct proportion (Worwood, 1990).

**Chamomile**

This essential oil is extracted by distillation from the dried chamomile flowers, or the herb. There are two varieties:

- Anthemis nobilis (Roman chamomile)
- Matricaria chamomile (German chamomile)

Both the German and Roman chamomile have the same properties (Sellar, 1992), although the German is mild and the Roman is strong (Jackson, 1986).

The chemical constituents of German chamomile, are aldehyde and sesquiterpene (Sellar, 1992) and it also contains azulene which has remarkable healing and antibacterial powers (Jackson, 1986). The German chamomile contains more azulene than the Roman chamomile (Price, 1987).

As this essential oil is an emmenagogue, it should be avoided in the early months of pregnancy (Sellar, 1992), however the oil has a low toxicity (Price, 1987).

Chamomile has analgesic, antidepressant, antispasmodic, carminative, sedative properties, and as it is a soothing oil, with a fruity apple-like fragrance, it eases anxiety, tension,
anger and fear. It promotes relaxation, gives patience, peace and allays worries.

Its analgesic action eases dull muscular pain, and low back pain responds well to it (Sellar, 1992).

Price (1987) also suggests the use of chamomile for all muscular aches and pains, anxiety, depression and inflammation. Jackson (1986), Tisserand (1977) and Beard are in agreement.

**Lavender**

This is a floral, light and clear essential oil with woody undertones. It is extracted via distillation from the flowers of the lavender shrub, and its Latin name is Lavandula officinalis. Its chemical constituents are: borneol, geraniol, lavandulyl acetate, linalyl acetate (ester), cineole (ketone), caryophylene (sesquiterpene), limonene, pinene (terpenes).

Some of its properties are: analgesic, antidepressant, antispasmodic, antiviral, bacteriacidal, carminative, decongestant, detoxicant, diuretic, nervine, restorative and sedative.

As this oil too, is an emmenagogue, it should be avoided in the early months of pregnancy.

It has a positive effect on psychological disorders, and results in a calmer approach to life. It also has a balancing action on the central nervous system. Its pain relieving qualities deal effectively with muscular spasm (Sellar, 1992).

Lavender generally acts best in conjunction with another oil, and may be used for muscular aches and pains, anxiety and depression,
general debility and irritability (Price, 1987).

Jackson (1986), claims that lavender has antispasmodic properties, and relieves pain by calming the cerebrospinal area, therefore being able to treat nervous conditions.

The Aromatherapy, Aide Memoire Series, also comments that lavender may be used as a calmative for stress.

Holmes (1992), states that lavender is a harmoniser of opposites and a reconciler of contradictions. Stress that becomes counterproductive on the physiological level involves either the sympathetic or parasympathetic nervous system. Lavender essential oil has been shown to inhibit both sympathetic and parasympathetic nervous system functions. Essential oils work in concert with the individual's vitality, and so the body responds to the oil according to its needs. By selectively inhibiting either sympathetic or parasympathetic nervous excess, lavender can therefore assist our responses to unproductive stress of any kind.

A feature in The International Journal of Aromatherapy (1988), writes about aromatherapy and essential oils being a common presence in several Oxford hospitals. They use the essential oils, mainly lavender, to enhance analgesia, especially when patients suffer from arthritic pain, those who are tense, or those who have some muscle spasm. A bath or a massage with lavender, often works faster than oral analgesia.
CHAPTER THREE
MATERIALS AND METHODS

3.1 THE DATA

The data of this research was of two kinds:

- primary data
- secondary data

The nature of each of these two subtypes of data will be given briefly below.

3.1.1 The Primary Data

- patient's pain level
- patient's perception of their general well-being
- patient's dorsolumbar range of motion

3.1.2 The Secondary Data

- recognised diagnostic and evaluative criteria pertaining to perception of pain, spinal ranges of motion and general well being

3.2 THE CRITERIA GOVERNING THE ADMISSIBILITY OF THE DATA

- Only the questionnaires and numerical pain rating scales completed under the researcher's supervision, or the supervision of the chiropractor in charge, or
any other fifth year chiropractic intern, were used.

- only the range of motion measurements taken by the researcher, the chiropractor in charge or any other fifth year chiropractic intern, were used.

- Data were only used from patients if they had complied with all instructions.

3.3 LOCATION OF THE DATA

The primary data were elicited from the Numerical Pain Rating Scale and the General Well-Being Schedule, answered by the patients, as well as from the dorsolumbar ranges of motion readings, recorded in the clinic.

The secondary data were found in books and journals, available on the Berea Campus of Technikon Natal.

3.4 THE RESEARCH METHODOLOGY

Extensive advertising was undertaken to acquire patients for the study. Patients were either technikon staff, or technikon students or any other outsiders, over the age of 14.

The initial consultation included the taking of a full case history, physical examination and regional low back examination (Appendix C, Appendix D, Appendix E). The patients were then screened and examined for the manifestation of the recognised signs and symptoms of mechanical low back pain, reinforced if necessary by X-ray examination. The patients were also screened for contra-indications to lavender oil (pregnancy) and chamomile oil (pregnancy), as well as
any contra-indications to massage (acute circulatory disorders; acute inflammation; malignancy; oedema secondary to heart decompensation, kidney disease, embolus, obstruction of lymph channels, thrombus; skin conditions such as acute burns, acne, eczema, furuncles, ulcerations, and wounds; communicable disease and hyperesthesia of the skin). The initial consultation also included the recording of the patient's dorsolumbar range of motion, measured with a goniometer (American Medical Association, 1983), and the patient was also required to complete the General Well-Being Schedule (Appendix F) and the Numerical Pain Rating scale (Appendix G).

The sample size consisted of 20 patients, and the patients who were eligible for the study, were randomly divided into:

i) control group (10 patients)

ii) experimental group (10 patients)

The duration of this project extended over 30 days per patient. The first treatment commenced as soon as possible after the initial consultation, with two to three treatments per week. There were 8 treatments in total, with a final complete re-evaluation one week after the eighth treatment.

The experimental group received application of the essential oils (Formula 1a, Appendix H) using effleurage massage (Appendix I) only.

The control group received application of the carrier oil, using effleurage massage (Formula 1b, Appendix H, and Appendix I) only.
The control group received application of the carrier oil, using effleurage massage (Formula 1b, Appendix H, and Appendix I) only.

For the duration of the three week period during which the patients received treatment, as well as during the first week after the eighth treatment, the patients were instructed to refrain from any unusual activities which may have exacerbated their condition.

Both the patients from the control group and the experimental group, were required to complete the Numerical Pain Rating Scale before each treatment and their dorsolumbar range of motion was also assessed. The final complete re-evaluation, one week after the eighth treatment, included the re-evaluation of any positive findings of the regional low back examination, and also included the recording of the dorsolumbar range of motion, and the patients were required to complete the General Well-Being Schedule as well as the Numerical Pain Rating Scale.

3.5 THE TREATMENT OF THE DATA

The level of pain (derived from the Numerical Pain Rating Scale) and the dorsolumbar ranges of motion (measured with a goniometer), were needed in order to solve the first subproblem, which is to evaluate the effects of essential oils, applied by means of effleurage massage, in terms of the patient's physical response to the treatment, in order to determine the physical changes that may occur, in the use of essential oils in the management of mechanical low back pain.
The scores obtained from the General Well-being Schedules, completed by the patients, were needed in order to solve the second subproblem, which is to evaluate the effects of essential oils, applied by means of effleurage massage, in terms of the patient's psychological response to the treatment, in order to determine the psychological changes that may occur, in the use of essential oils in the management of mechanical low back pain.

The Numerical Pain Rating Scales and the General Well-Being Schedules, completed by each patient, were screened to determine that they were correctly completed.

The units on the Numerical Pain Rating Scales, completed by each patient, were then converted into percentages, and these percentages were then recorded separately for the control and experimental group. See Table 3.1.1 and Table 3.1.2.

The mean percentage of the pain rating, for each consultation was calculated for both the control and experimental group, and is depicted by Figure 3.1.

Range of motion measurements for each patient, were recorded in degrees for flexion, left and right lateral flexion, and extension. The percentage impairment for flexion, left and right lateral flexion and extension, was then calculated (Appendix J), and the total impairment of whole man for each patient was calculated, and recorded. See Table 3.2.1 and Table 3.2.2.
### Table 3.1.1

**Percentage pain: Control group**

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<th>Rx 3</th>
<th>Rx 4</th>
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### Table 3.1.2

**Percentage pain: Experimental group**

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Rx = treatment
Figure 3.1

MEAN PERCENTAGE OF PAIN AT EACH CONSULTATION FOR THE CONTROL GROUP AND THE EXPERIMENTAL GROUP.

Rx = treatment    I = initial    F = final
Table 3.2.1

Range of motion, total impairment of whole man:
Control Group

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Mean 9.7 9.9 10.5 11.5 11.2 10.7 10.3 10.4 10.4 10.8

Table 3.2.2

Range of motion, total impairment of whole man:
Experimental Group

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<td>4</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Mean 7.6 7.5 7.3 6.5 5.9 5.5 5.4 5.3 4.5 5.9

Rx = treatment
The mean total impairment of whole man, was then calculated for each consultation, and is depicted respectively for the control and experimental group by Figure 3.2.

The scores obtained from the General Well-Being Schedules were recorded for each patient, at the initial consultation and the final consultation. See Table 3.3.1 (Control group) and Table 3.3.2 (Experimental group).

3.6 STATISTICAL PROCESSING OF THE DATA

The significance of the change in pain, and the significance of the change in impairment of whole man, in each of the control and experimental groups, was analyzed by means of the Wilcoxon Signed Rank Test (at a significance level of 5%), between:

i) Initial consultation and treatment 1

ii) Initial consultation and treatment 8

iii) Initial consultation and final consultation

iv) Treatment 1 and treatment 8

v) Treatment 1 and final consultation

vi) Treatment 8 and final consultation,

The significance of the change in general well-being, for each of the control and experimental groups, was analyzed by means of the Wilcoxon Signed Rank Test (at a significance level of 5%), between the initial consultation and final consultation.
Figure 3.2

MEAN TOTAL IMPAIRMENT OF WHOLE MAN AT EACH CONSULTATION FOR THE CONTROL GROUP AND THE EXPERIMENTAL GROUP.
**Table 3.3.1**

**General Well-being Scores: Control Group**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Initial</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>73</td>
<td>70</td>
</tr>
<tr>
<td>2</td>
<td>57</td>
<td>59</td>
</tr>
<tr>
<td>3</td>
<td>82</td>
<td>77</td>
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<tr>
<td>4</td>
<td>93</td>
<td>94</td>
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<td>5</td>
<td>67</td>
<td>81</td>
</tr>
<tr>
<td>6</td>
<td>71</td>
<td>79</td>
</tr>
<tr>
<td>7</td>
<td>63</td>
<td>87</td>
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<tr>
<td>8</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>9</td>
<td>81</td>
<td>83</td>
</tr>
<tr>
<td>10</td>
<td>92</td>
<td>101</td>
</tr>
</tbody>
</table>

**Mean** 71.5 77.3

**Table 3.3.2**

**General Well-being Scores: Experimental Group**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Initial</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>69</td>
</tr>
<tr>
<td>2</td>
<td>47</td>
<td>34</td>
</tr>
<tr>
<td>3</td>
<td>61</td>
<td>65</td>
</tr>
<tr>
<td>4</td>
<td>86</td>
<td>87</td>
</tr>
<tr>
<td>5</td>
<td>87</td>
<td>88.5</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>84</td>
</tr>
<tr>
<td>7</td>
<td>66</td>
<td>63</td>
</tr>
<tr>
<td>8</td>
<td>83</td>
<td>78</td>
</tr>
<tr>
<td>9</td>
<td>54</td>
<td>89</td>
</tr>
<tr>
<td>10</td>
<td>86</td>
<td>85</td>
</tr>
</tbody>
</table>

**Mean** 67.5 74.25
The Wilcoxon Signed Rank Test was chosen because of its less restrictive assumptions and near equivalence in sensitivity to the t-test (Siegel, 1956).

The significance of the change in pain, and the significance of the change in total impairment of whole man, between the control and experimental groups, was analyzed by means of the Mann-Whitney U-Test (at a significance level of 5%), at:
   i) initial consultation
   ii) treatment 1
   iii) treatment 8
   iv) final consultation,

The significance of the change in general well-being, between the control and experimental group, was analyzed by means of the Mann-Whitney U-Test (at a significance level of 5%), at the initial consultation and the final consultation.

The Mann-Whitney U-test was chosen as it does not have the restrictive assumptions and requirements associated with the t-test, and is the most powerful non-parametric test (Siegel, 1956).

All statistical analysis was executed using the Statgraphics Plus Version 6, supplied by Manugistics, Inc., at the Berea Campus of Technikon Natal.
4.1 PAIN

4.1.1 Wilcoxon Signed Rank Test

a) Control Group:

i) Initial consultation and treatment 1, \( P = 0.834 \), thus no significant difference;
3 positive differences
5 negative differences
Note: 10 total pairs, 2 tied pairs ignored

ii) Initial consultation and treatment 8, \( P = 0.009 \), thus a significant difference;
8 positive differences
1 negative difference
Note: 10 total pairs, 1 tied pairs ignored

iii) Initial consultation and final consultation, \( P = 0.009 \), thus a significant difference;
8 positive differences
1 negative difference
Note: 10 total pairs, 1 tied pairs ignored
iv) Treatment 1 and treatment 8, \( P = 0.010 \), thus a significant difference;
8 positive differences
0 negative differences
Note: 10 total pairs, 2 tied pairs ignored

v) Treatment 1 and final consultation, \( P = 0.010 \), thus a significant difference;
8 positive differences
0 negative differences
Note: 10 total pairs, 2 tied pairs ignored

vi) Treatment 8 and final consultation, \( P = 0.050 \), thus no significant difference;
0 positive differences
1 negative difference
Note: 10 total pairs, 9 tied pairs ignored

b) Experimental Group:

i) Initial consultation and treatment 1, \( P = 0.210 \), thus no significant difference;
5 positive differences
3 negative differences
Note: 10 total pairs, 2 tied pairs ignored
ii) Initial consultation and treatment 8, $P = 0.006$, thus a significant difference;
9 positive differences
0 negative differences
Note: 10 total pairs, 1 tied pairs ignored

iii) Initial consultation and final consultation, $P = 0.006$, thus a significant difference;
9 positive differences
0 negative differences
Note: 10 total pairs, 1 tied pairs ignored

iv) Treatment 1 and treatment 8, $P = 0.006$, thus a significant difference;
9 positive differences
0 negative differences
Note: 10 total pairs, 1 tied pairs ignored

v) Treatment 1 and final consultation, $P = 0.006$, thus a significant difference;
9 positive differences
0 negative differences
Note: 10 total pairs, 1 tied pairs ignored
vi) Treatment 8 and final consultation, \( P = 0.920 \), thus no significant difference;
3 positive differences
3 negative differences
Note: 10 total pairs, 4 tied pairs ignored

4.1.2 Mann-Whitney U-test

Control Group : Experimental Group

i) Initial consultation, \( P = 0.280 \), thus no significant difference
ii) Treatment 1, \( P = 0.906 \), thus no significant difference
iii) Treatment 8, \( P = 0.261 \), thus no significant difference
iv) Final consultation, \( P = 0.353 \), thus no significant difference

4.2 TOTAL IMPAIRMENT OF WHOLE MAN

4.2.1 Wilcoxon Signed Rank Test

a) Control Group:

i) Initial consultation and treatment 1, \( P = 0.715 \), thus no significant difference;
2 positive differences
2 negative differences
Note: 10 total pairs, 6 tied pairs ignored

ii) Initial consultation and treatment 8, $P = 0.286$, thus no significant difference;
4 positive differences
5 negative differences
Note: 10 total pairs, 1 tied pairs ignored

iii) Initial consultation and final consultation, $P = 0.272$, thus no significant difference;
3 positive differences
4 negative differences
Note: 10 total pairs, 3 tied pairs ignored

iv) Treatment 1 and treatment 8, $P = 0.445$, thus no significant difference;
5 positive differences
5 negative differences
Note: 10 total pairs, 0 tied pairs ignored

v) Treatment 1 and final consultation, $P = 0.236$, thus no significant difference;
4 positive differences
5 negative differences
Note: 10 total pairs, 1 tied pairs ignored
vi) Treatment 8 and final consultation, \( P = 0.345 \), thus no significant difference;
2 positive differences
4 negative differences
Note: 10 total pairs, 4 tied pairs ignored

b) Experimental Group:

i) Initial consultation and treatment 1, \( P = 0.834 \), thus no significant difference;
3 positive differences
3 negative differences
Note: 10 total pairs, 4 tied pairs ignored

ii) Initial consultation and treatment 8, \( P = 0.021 \), thus a significant difference;
8 positive differences
1 negative difference
Note: 10 total pairs, 1 tied pairs ignored

iii) Initial consultation and final consultation, \( P = 0.327 \), thus no significant difference;
5 positive differences
3 negative differences
Note: 10 total pairs, 2 tied pairs ignored
iv) Treatment 1 and treatment 8, \( P = 0.010 \), thus a significant difference;
8 positive differences
0 negative differences
Note: 10 total pairs, 2 tied pairs ignored

v) Treatment 1 and final consultation, \( P = 0.183 \), thus no significant difference;
5 positive differences
3 negative differences
Note: 10 total pairs, 2 tied pairs ignored

vi) Treatment 8 and final consultation, \( P = 0.050 \), thus no significant difference;
1 positive difference
7 negative differences
Note: 10 total pairs, 2 tied pairs ignored

4.2.2 Mann-Whitney U-test

Control Group : Experimental Group

i) Initial consultation, \( P = 0.169 \), thus no significant difference

ii) Treatment 1, \( P = 0.192 \), thus no significant difference

iii) Treatment 8, \( P = 001 \), thus a significant difference

Average rank of control group = 14.75 based on 10 values
Average rank of experimental group = 6.25 based on 10 values
iv) Final consultation, \( P = 0.007 \), thus a significant difference
Average rank of control group = 14.05 based on 10 values
Average rank of experimental group = 6.95 based on 10 values

4.3 GENERAL WELL-BEING

4.3.1 Wilcoxon Signed Rank Test

a) Control Group:

i) Initial consultation and final consultation, \( P = 0.053 \), thus no significant difference

b) Experimental Group:

i) Initial consultation and final consultation, \( P = 0.333 \), thus no significant difference

4.3.2 Mann-Whitney U-test

Control Group : Experimental Group

i) Initial consultation, \( P = 0.520 \), thus no significant difference
Average rank of control group = 11.4
Average rank of experimental group = 9.6
ii) Final consultation, \( P = 0.880 \), thus no significant difference
Average rank of control group = 10.75 based on 10 values

Average rank of experimental group = 10.25 based on 10 values
5.1 PAIN

5.1.1 Wilcoxon Signed Rank Test

a) Control Group:

Between the initial consultation and treatment 1, there is no significant difference, thus the level of pain remained constant until treatment commenced. Between the initial consultation and treatment 8, and treatment 1 and treatment 8, there is a significant difference, and as in both cases the number of positive differences outnumber the number of negative differences, there has been a significant decrease in pain, during the period of treatment. Between the initial consultation and the final consultation, and treatment 1 and the final consultation, there is also a significant decrease in pain. Between treatment 8 and the final consultation, there is no significant difference, thus the significant decrease in pain achieved during the period of treatment, was maintained for approximately 1 week after the last treatment (treatment 8).
b) Experimental Group:

Between the initial consultation and treatment 1 there is no significant difference, thus indicating that the level of pain remained constant until treatment commenced. Between the initial consultation and treatment 8, and treatment 1 and treatment 8, there is a significant difference, with the number of positive differences outweighing the number of negative differences, thus there being a significant decrease in pain during the period of treatment. Between the initial consultation and the final consultation, and treatment 1 and the final consultation, there has been a significant decrease in pain. Between treatment 8 and the final consultation there is no significant difference, and thus the significant decrease in pain achieved during the period of treatment was maintained between the final treatment (treatment 8) and the final consultation.

5.1.2 Mann-Whitney U-Test

Control Group : Experimental Group

At the initial consultation there is no significant difference and at treatment 1 there is no significant difference, indicating that both groups were experiencing a similar level of pain before treatment commenced. At treatment 8 there is no significant difference, and at the final consultation there is no significant difference, indicating that both groups were experiencing a
similar level of pain at the conclusion of treatment.

5.2 TOTAL IMPAIRMENT OF WHOLE MAN

5.2.1 Wilcoxon Signed Rank Test

a) Control Group:

Between the initial consultation and treatment 1 there is no significant difference, thus indicating that the total impairment of whole man remained constant until treatment commenced. Between the initial consultation and treatment 8, and treatment 1 and treatment 8, there is no significant difference, indicating that the total impairment of whole man was not reduced significantly with treatment. Between the initial consultation and the final consultation, and treatment 1 and the final consultation there is no significant difference. Between treatment 8 and the final consultation there is no significant difference.

b) Experimental Group:

Between the initial consultation and treatment 1 there is no significant difference, indicating that the total impairment of whole man remained constant until treatment commenced. Between the initial consultation and treatment 8, and treatment 1 and treatment 8, there is a significant difference, with the number of positive differences outweighing the number of negative
differences, thus indicating a significant decrease in the total impairment of whole man during the period of treatment. Between the initial consultation and the final consultation, and treatment 1 and the final consultation there is no significant difference, thus indicating that the overall effect of treatment was not maintained during the week after the last treatment (treatment 8). However, between treatment 8 and the final consultation, there is no significant difference, which would indicate that the decrease in total impairment of whole man was maintained during the week after the final treatment. The P value is 0.050, and the number of negative differences outweigh the number of positive differences, indicating that the total impairment of whole man is on the border of swinging back to what it was before treatment commenced.

5.2.2 Mann-Whitney U-Test

Control Group : Experimental Group

At the initial consultation and at treatment 1, there is no significant difference, indicating that both groups had a similar total impairment of whole man before treatment commenced. At treatment 8 however, there is a significant difference, with the average rank of the control group being higher than that of the experimental group, indicating that at treatment 8, the experimental group had a smaller total impairment of whole man, than the control group. At the final consultation a significant difference is noted, with the average rank of the control group
being higher than the average rank of the experimental group, indicating that at the final consultation, the experimental group had a smaller total impairment of whole man than the control group.

5.3 GENERAL WELL-BEING

5.3.1 Wilcoxon Signed Rank Test

Between the initial consultation and the final consultation in both the control and experimental group, no significant difference is noted, thus indicating that treatment employed in both the control and experimental group did not change the patient's general well-being significantly.

5.3.2 Mann-Whitney U-Test

At the initial consultation, no significant difference is noted, thus the patients of both groups, had a similar level of general well-being before treatment commenced. At the final consultation, no significant difference is noted, thus indicating that both groups had a similar level of general well-being 1 week after the final treatment (treatment 8).
with regard to the level of pain, both the control and experimental group displayed a significant decrease in pain between the initial consultation and treatment 8, and treatment 1 and treatment 8, and both maintained the significant decrease between treatment 8 and the final consultation. However, no significant difference between the control and experimental group is observed in response to the respective treatments. This partly supports Hypothesis 1.3.1, which states that it is hypothesized that the use of essential oils in the treatment of mechanical low back pain will result in a reduction in the patient's perception of pain, as well as an increase in the patient's range of motion. This does not support Hypothesis 1.3.4, which states that the carrier oils used in this controlled study will have no significant physical effects.

With regard to the total impairment of whole man, the control group did not display a significant decrease between the initial consultation and treatment 8, and treatment 1 and treatment 8; whereas the experimental group did (see Figure 4.1), and also between treatment 8 and the final consultation no statistical significant difference was noted in the experimental group, indicating that the significant decrease of total impairment was maintained during the week after treatment 8, although no statistical significant difference was displayed between treatment 1 and the final consultation. This further indicates that the total impairment of
Rx = treatment

Figure 4.1

MULTIPLE X-Y PLOT OF THE TOTAL IMPAIRMENT OF WHOLE MAN AT TREATMENT 1 AND TREATMENT 8 FOR THE EXPERIMENTAL GROUP.
whole man is on the border of swinging back to what it was before treatment commenced. This is displayed by Figure 4.2 and Figure 4.3. No significant change was noted between the control and experimental group at the initial consultation (see Figure 4.4) and treatment 1, however, a significant change was observed between the control and experimental group at treatment 8 (see Figure 4.5) and also at the final consultation (see Figure 4.6). This partly supports Hypothesis 1.3.1 which states that it is hypothesized that the use of essential oils in the treatment of mechanical low back pain will result in a reduction in the patient's perception of pain, as well as an increase in the patient's range of motion. This also partly supports Hypothesis 1.3.4 which states that it is hypothesized that the carrier oils used in this controlled study will have no significant physical or psychological effects.

With regard to the general well-being scores, no significant change is noted between the initial and the final consultation in both the control and the experimental groups. Also, no significant change is noted between the groups at the initial and the final consultation. This partly supports Hypothesis 1.3.4 which states that it is hypothesized that the carrier oils used in this controlled study will have no significant physical or psychological effects; but does not support Hypothesis 1.3.2 which states that it is hypothesized that the use of essential oils in the treatment of mechanical low back pain will result in an increased level of the patient's perception of well-being.
Rx = treatment

Figure 4.2

MULTIPLE X-Y PLOT OF THE TOTAL IMPAIRMENT OF WHOLE MAN AT TREATMENT 8 AND THE FINAL CONSULTATION FOR THE EXPERIMENTAL GROUP.
Figure 4.3

MULTIPLE X-Y PLOT OF THE TOTAL IMPAIRMENT OF WHOLE MAN AT TREATMENT 1 AND THE FINAL CONSULTATION FOR THE EXPERIMENTAL GROUP.

Rx = treatment
Figure 4.4

Figure 4.5

MULTIPLE X-Y PLOT OF THE TOTAL IMPAIRMENT OF WHOLE MAN AT TREATMENT 8, BETWEEN THE CONTROL GROUP AND THE EXPERIMENTAL GROUP.
Figure 4.6

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

The results of this controlled study show that essential oils applied by means of effleurage massage, are effective in the management of mechanical low back pain, in terms of the significant decrease in total impairment of whole man, as demonstrated by the increase in the patient's dorsolumbar range of motion, and a significant decrease in the patient's level of pain; and thus supporting hypothesis 1.3.1.

The control group also experienced a significant decrease in pain, and it is thus concluded that effleurage massage with the carrier oil, almond oil, is also an effective form of pain reduction in the management of mechanical low back pain.

It appears that the reduction in pain in the control group is most likely due to the beneficial effects of massage, as massage is indeed indicated to relieve certain kinds of pain (Tappan, 1984). The relief of pain in the experimental group is also most likely due to the effects of massage. The essential oils chamomile and lavender, however did not have strong enough analgesic properties to cause a significant change in the level of pain between the two groups. It is recommended that further studies be conducted to determine whether other essential oils have greater analgesic properties in the management of mechanical low back pain, than a combination of lavender oil and chamomile oil.
The reduction of total impairment of whole man in the experimental group, which was not demonstrated in the control group, is most likely attributed to the antispasmodic properties of chamomile and lavender essential oils (Sellar, 1992). These could have resulted in a decrease in muscle spasm, thus increasing the range of motion, and so decreasing the total impairment of whole man.

General well-being in both the control and experimental group was recorded only for the initial consultation and the final consultation. No significant difference between these two consultations was noted in either of the groups. It is recommended that future studies evaluate the general well-being at the final treatment, in addition to at the initial consultation and the final consultation (i.e. re-evaluation after 1 week).

Effleurage massage of patients suffering from mechanical low back pain, with or without the use of the essential oils of chamomile or lavender, is definitely beneficial in the management of these patients, as regards pain levels, when the chiropractic adjustment does not form part of the treatment. Effleurage massage with the essential oils of chamomile and lavender, however significantly decreased the total impairment of whole man. Effleurage massage with these essential oils could play a significant role in the rehabilitation of patients with mechanical low back pain, when the chiropractic adjustment does not form part of the treatment programme.

It is recommended that future studies be conducted with an increased time span between the final treatment and the final re-evaluation.
consultation, so as to determine the long term effects of the essential oils chamomile and lavender, in the management of patients with mechanical low back pain. Future studies could also be conducted to determine whether effleurage massage with the essential oils of chamomile and lavender, enhances the management of patients with mechanical low back pain, where the chiropractic adjustment forms part of the treatment.


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Worwood V.A. 1990. The Fragrant Pharmacy. London, Transworld Publisher's Limited
Ms Regina Luders  
9 Graell  
38 Gordon Rd  
Morningside  
4001, Durban  
Republic of South Africa

Dear Regina,

Your letter has been passed to me by Sylvia Baker of Shirley Price Aromatherapy Ltd. Although we have had successes with Aromatherapy, where other treatments have failed, we have not carried out any specific trials to identify what caused the "cure". Is it the oils or just our healing hands? As you are probably very aware, every sufferer is an individual and dependant on which structures generate pain, and why, different responses are gained if the same approach is made in every case.

At the present time I am not aware of any properly controlled research specifically into the effects of essential oils on low back pain, although there are many case histories of relief after a course of Aromatherapy treatments. One of the best sources of information on essential oils is the book by Dr Jean Valnet, 'The Practice of Aromatherapy' published by The C W Daniel Company Ltd.

I am sorry that we are unable to source you more scientific data, unfortunately, Aromatherapists believe and know, but have little scientific proof to support their knowledge. It is coming, the antibacterial properties of essential oils is proven, and psychiatric hospitals are reporting benefits of inhaled oils over night medication. The International Federation of Aromatherapists is researching the effects on Rheumatoid Arthritis, Shirley Price Aromatherapy Ltd in co operation with the Parkinson's Disease Society is researching in that direction.

With some 'leading authorities' believing all back pain stems from just one of the structures of the spine in all cases, research results may be confusing, who knows?

We wish you well in your project.

Yours sincerely,

David Tagg
8th September 1992

Regina G. Luders
9 Graeli
38 Gordon Road
Morningside
4001 Durban
Republic of South Africa

Dear Ms. Luders,

Thank you for your letter dated 2nd August which arrived while I was on holiday.

I regret to say that there is no information available on musculo-skeletal dysfunction of any kind. However the literature on the psychological effects of essential oils is vast. Please tell me more specifically which psychological effects you are interested in.

We would certainly be able to help, for example on the sedative/anxiety relieving effects of essential oils.

For your interest I have also enclosed our mail order catalogue with particular reference to books, the International Journal of Aromatherapy and Aroma'93.

Yours sincerely,

Robert Tisserand
APPENDIX C:

TECHNIKON NATAL CHIROPRACTIC DAY CLINIC

CASE HISTORY

Patient: __________________________ Date #: __________

File #: __________

X-ray #: __________

Age: _______ Sex: _______ Occupation: _________

Intern: ________________________ Signature: __________

FOR CLINICIAN'S USE ONLY

Initial visit clinician: __________________________ Signature: __________

Case History:

Examination:
    Previous: TN Other
    Current: TN Other

X-ray Studies:
    Previous: TN Other
    Current: TN Other

Clinical path. lab.:
    Previous: TN Other
    Current: TN Other

Case status:
    PTT: Conditional
    Signed off: __________
    Final sign out: __________

Recommendations:
Intern's case history

1. Source of history:

2. Chief complaint: (patient's own words)

3. Present illness:

   Location

   Onset

   Duration

   Frequency

   Pain (character)

   Progression

   Aggravating factors

   Relieving factors

   Associated S & S

   Previous occurrences

   Past treatment and outcome
4. Other complaints:

5. Past history:

   General health status

   Childhood illnesses

   Adult illnesses

   Psychiatric illnesses

   Accidents/injuries

   Surgery

   Hospitalizations
6. Current health status and life-style:
   Allergies
   Immunizations
   Screening tests
   Environmental hazards
      (home, school, work)
   Safety measures
      (seat belts, condoms)
   Exercise and leisure
   Sleep patterns
   Diet
   Current medication
   Tobacco
   Alcohol
   Social drugs

7. Family history:
   Immediate family:
      Age
      Health
      Cause of death
      DM
      Heart disease
      TB
      HBP
      Stroke
      Kidney disease
      CA
      Arthritis
      Anaemia
      Headaches
      Thyroid disease
      Epilepsy
      Mental illness
      Alcoholism
      Drug addiction
      Other
8. Psychosocial history:
   Home situation
   Daily life
   Important experiences
   Religious beliefs

9. Review of systems:
   General
   Skin
   Head
   Eyes
   Ears
   Nose/sinuses
   Mouth/throat
   Neck
   Breasts
   Respiratory
   Cardiac
   Gastro-intestinal
   Urinary
Genital

Vascular

Musculoskeletal

Neurologic

Haematologic

Endocrine

Psychiatric.
PHYSICAL EXAMINATION

Underline abnormal findings in RED and elaborate on back of relevant page, if necessary. Mark "NAD" if normal.

Patient: ____________________________ File #: __________

Last name  First name

Clinician: ______________ Signature: ______________

Intern: ______________ Signature: ______________

Date: ______________

Height: _______  Weight: _______  Temp: _______

Rates: Heart: _____  Pulse: _____  Respiration: _______

Blood pressure: Arms: L  /  R  /

Legs: L  /  R  /

General appearance:
STANDING EXAMINATION.

Minor's sign
Skin changes
Posture
  erect
  Adam's
"Ranges of motion:

T/L spine: Flexion: 90 Fingers to floor
  Extension: 50
  R.lat.flex.: 30 Fingers down leg
  L.lat.flex.: 30 Fingers down leg
  Rot.to R.: 35
  Rot.to L.: 35

Flex.

  L.Rot.    R.Rot.

  L.lat  R.lat
  flex.   flex.

Ext.

/ = pain-free limitation; // = painful limitation.

Romberg's sign.
Pronator drift.
Trendelenburg's sign.
Gait.
  rhythm
  balance
  pendulousness
  on toes
  on heels
  tandem
Half squat.
Scapular winging.
Muscle tone.
Spasticity/Rigidity.
Shoulder:
  skin
  symmetry
  ROM - glenohumeral
    scapulo-thoracic
    acromioclavicular
    elbow
    wrist
Chest measurement
  inspiration
  expiration
Visual acuity

Breast examination:
  Inspection:
    skin
    size
    contour
    nipples
    arms overhead
    hands against hips
    leaning forward.
  Palpation:
    axillary lymph nodes.

SEATED EXAMINATION.

Spinal posture
Head
  scalp
  skull
  face
  skin
Eyes
  conjunctiva
  sclera
  eyebrows
  eyelids
  lacrimal gland
  nasolacrimal duct
  alignment
  corneal reflex
  ocular movement
  
  visual fields
  accommodation
  iris
  pupils
  red reflex
  optic disc

L III IV VI
R III IV VI
vessels
general background
macula
vitreous
lens
Ears:
auricle
ear canal
drum
auditory acuity
Weber test
Rinne test

Nose:
external
internal
   septum
turbinates
olfaction
Sinuses (frontal & maxillary):
tenderness
transillumination
Mouth and pharynx:
lips
buccal mucosa
gums and teeth
roof
tongue
   inspection
   movement
taste
   palpation
pharynx
   inspection
CN X
Neck:
posture
size
swelling
scars
discoloration
hair line
ROM:

Flexion: 45 chin to larynx
       chin to sternum

Extension: 55 forehead parallel
to floor

L.lat.flex: 40
R.lat.flex: 40
L.rot.: 70
R.rot.: 70

Flex.

L.Rot.  R.Rot.

L.Lat.  R.lat.
flex.   flex.

Ext.

lymph nodes
trachea
thyroid
carotid arteries (thrills, bruit)
CH V
CH VII
CH VIII (nystagmus)
CH IX
CH XI
TMJ
Inspection
ROM
deviation
Palpation
crepitus
tenderness
Neurological:
  Dermatomes
    C5
    C6
    C7
    C8
    T1
  Tendon reflexes
    biceps
    triceps
    brachioradialis
  Muscle strength
    C5
    C6
    C7
    C8
    T1
  Coordination:
    point-to-point
dysdiadochokinesia
Thorax:
  Chest:
    Inspection:
      skin
      shape
      respiratory distress
      rhythm (respiratory)
      depth
      effort
      intercostal/supraclavicular retraction
    Palpation:
      tenderness
      masses
      respiratory expansion
      tactile fremitus
    Percussion:
      lungs (posterior)
      diaphragmatic excursion
      kidney punch
    Auscultation:
      breath sounds
      vesicular
      bronchial
      adventitious sounds
      crackles (rales)
      wheezes (rhonchi)
      voice sounds
      broncophony
      whispered pectoriloquy
      egophony
Cardiovascular:
  auscultation (aortic murmurs)
  Allen's test

SUPINE EXAMINATION

JVP
PMI
  auscultation heart (L.lat.recumbent)
  respiratory excursion
  percussion chest (anterior)
  breast palpation

The abdomen:
  Inspection:
    skin
    umbilicus
    contour
    peristalsis
    pulsations
    hernias (umbilical/incisional)
  Auscultation:
    bowel sounds
    bruit
  Percussion:
    general
    liver
    spleen
  Palpation:
    superficial reflexes
    cough
    light
    rebound tenderness
    deep
    liver
    spleen
    kidneys
    aorta
    intra-/retro-abdominal wall mass
    shifting dullness
    fluid wave

Acute abdomen:
  where pain began and now
  cough
  tenderness
  guarding/rigidity
  rebound tenderness
  Rovsing's sign
  psoas sign
  obturator sign
  cutaneous hyperaesthesia
  rectal exam
  Murphy's sign.
Male genitals and hernias.
Inspection:
   skin
   prepuce
   glans
   meatus
   nits/lice
   scrotum
   inguinal/femoral bulges
Palpation:
   penis (tenderness/induration)
   testes
   epididymis
   inguinal canal
   femoral canal
   cremasteric reflex
Auscultation:
   scrotal mass.
Peripheral vasculature:
Inspection:
   skin
   nail beds
   pigmentation
   hair loss
Palpation:
   pulses - radial, brachial, femoral, popliteal, post.tibial, dorsalis pedis
   lymph nodes - epitrochlear, femoral (horizontal & vertical)
   temperature (feet & legs)
Manual compression test
Retrograde filling (Trendelenburg) test
Arterial insufficiency test
Musculoskeletal:
   ROM
   hip
      flex.  90/120
      ext.  15
      abd.  45
      add.  30
      int rot 40
      ext rot 45
   knee
      flex. 130
      ext.  0/15
   ankle
      plantar flex  45
      dorsiflex  20
      inversion  30
      eversion  20
   leg length
Neurological:
dermatomes
  L1
  L2
  L3
  L4
  L5
  S1
muscle strength
  hip flexion
  knee extension
  ankle dorsiflexion
  plantar flexion
tendon reflexes
  patellar
  Achilles
plantar reflex
Rectal examination:
  Inspection
    sacrococcygeal & perianal areas
Palpation
  sphincter tone
  tenderness
  induration
  nodules
  prostate
  seminal vesicles

Mental status
  Appearance and behaviour:
    level of consciousness
    posture and motor behaviour
    dress, grooming, personal hygiene
    facial expression
    affect
  Speech and language:
    quantity
    rate
    volume
    fluency
    aphasia (prn)
Mood
  Thought processes (logical, relevant, organized)
Memory and attention:
  orientation (time, place, person)
  remote memory
  recent memory
  new learning ability
Higher cognitive functions:
  information and vocabulary (general & specialised knowledge)
  abstract thinking.
REGIONAL EXAMINATION - LOW BACK

Standing:

Minot's sign
posture
skin
muscle tone
spinous percussion
Schober's test (6cm)
Treadmill
R.O.M.

Flexion 15cm from floor.
Extension 30°

R. Lat flex 35° Fingers to knees
L. Lat flex 35° " " "

/ painless limitation
// painful limitation

R. rot. 30°
L. rot. 30°

Gait:
rhythm
on toes (or while standing)
on heels (or while standing)
half-squat on one leg.

Motion Palpation:
sacro-iliacs (see below for findings)

Sitting:

Posture
Dermatomos:

T12
L1
L2
L3
L4
L5
S1
S2
S3
Reflexes:
  - patellar
  - Achilles
  - medial hamstring

Reflexes: myotomes:
  - L.
  - R.
  - hip flex
  - hip int rot
  - hip ext rot
  - knee ext
  - knee flex
  - hip abd
  - hip add
  - ankle dorsiflex
  - ankle plantar flex
  - ankle eversion
  - ankle inversion
  - ext. hallucis long.

tripod
Kemp's

MOTION PALPATION:

<table>
<thead>
<tr>
<th>Jt.play</th>
<th>Left</th>
<th>Right</th>
<th>Jt.play</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/A Lat</td>
<td>Fle Ext</td>
<td>LF AR PR</td>
<td>Fle Ext</td>
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</tbody>
</table>

Supine:

- skin, hair, nails
- observe abdomen
- fasciculations
- abdominal reflexes
- auscultate abdomen/groin
- palpate abdomen/groin
- pulses (abd/ext)
- SLR
- Braggard's
- bowstring
- sciatic notch
- planter reflex
- circumference (thigh, calf)
leg length:
  actual
  apparent
Patrick FABER
Gaenslen's
gluteus max stretch
hip medial rotation
psoas test
Thomas' test:
  hip joint
  rectus femoris.

Lateral recumbent:
  S-I compression
  Ober's test
  femoral nerve stretch
myotomes:
  QL
  glut.med

Prone:
  gluteal skyline
  skin rolling
  iliac crest compression
  facet joint challenge
  S-I tenderness
  Erichsen's test
  Pheasant's test
myotomes:
  glut. max.
trigger points:
  QL
  glut. med
  glut. max
  piriformis
  hamstrings
  TFL

Non-organic signs:
  pin-point pain
  axial compression
  trunk rotation
  Burn's bench test
  flip test
  Hoover's test
  ankle dorsiflexion test
  pin-point pain.
GENERAL WELL-BEING SCHEDULE:

Dupuy (in McDowell and Newey, 1987), used a total score running from 0 to 110 and for this, 14 is subtracted from the score derived from the codes shown in Appendix 2.2.1 below.

- 0 - 60: severe distress
- 61 - 72: moderate distress
- 73 - 110: positive well being
**THE GENERAL WELL-BEING SCHEDULE**

**For each question, mark (X) the answer which best applies to you.**

<table>
<thead>
<tr>
<th>I. How have you been feeling in general during the past month?</th>
<th>a) In excellent spirits</th>
<th>b) In very good spirits</th>
<th>c) I have been up and down in spirits a lot</th>
<th>d) In low spirits mostly</th>
<th>e) In very low spirits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Have you been bothered by nervousness or your nerves during the past month?</td>
<td>a) Extremely so – could not work or take care of things</td>
<td>b) Very much so</td>
<td>c) Quite a bit</td>
<td>d) Some – enough to bother me</td>
<td>e) A little</td>
</tr>
<tr>
<td>3. Have you been in firm control of your behavior, thoughts, emotions or feelings during the past month?</td>
<td>a) Yes, definitely so</td>
<td>b) Yes, for the most part</td>
<td>c) Generally so</td>
<td>d) Not too well</td>
<td>e) No, and I am somewhat disturbed</td>
</tr>
<tr>
<td>4. Have you felt so sad, discouraged, hopeless, or had so many problems that you wondered if anything was worthwhile during the past month?</td>
<td>a) Extremely so – to the point that I have just about given up</td>
<td>b) Very much so</td>
<td>c) Quite a bit</td>
<td>d) Some – enough to bother me</td>
<td>e) A little bit</td>
</tr>
<tr>
<td>5. Have you been under or felt you were under any strain, stress, or pressure during the past month?</td>
<td>a) Yes – almost more than I could bear or stand</td>
<td>b) Yes – quite a bit of pressure</td>
<td>c) Yes – some, but about usual</td>
<td>d) Yes – some, but about usual</td>
<td>e) Yes – a little</td>
</tr>
<tr>
<td>6. How happy, satisfied, or pleased have you been with your personal life during the past month?</td>
<td>a) Extremely happy – could not have been more satisfied or pleased</td>
<td>b) Very happy</td>
<td>c) Fairly happy</td>
<td>d) Satisfied – pleased</td>
<td>e) Somewhat dissatisfied</td>
</tr>
</tbody>
</table>
7. Have you had any reason to wonder if you were losing your mind, or losing control over the way you act, talk, think, feel, or of your memory during the past month?

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</thead>
<tbody>
<tr>
<td>a)</td>
<td>Not at all</td>
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<tr>
<td>b)</td>
<td>Only a little</td>
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<tr>
<td>c)</td>
<td>Some - but not enough to be concerned or worried about</td>
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<tr>
<td>d)</td>
<td>Some and I have been a little concerned</td>
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<tr>
<td>e)</td>
<td>Some and I am quite concerned</td>
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<td>f)</td>
<td>Yes, very much so and I am very concerned</td>
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</table>

8. Have you been anxious, worried or upset during the past month?

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<tbody>
<tr>
<td>a)</td>
<td>Extremely so - to the point of being sick or almost sick</td>
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<tr>
<td>b)</td>
<td>Very much so</td>
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<tr>
<td>c)</td>
<td>Quite a bit</td>
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<tr>
<td>d)</td>
<td>Some - enough to bother me</td>
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<td>e)</td>
<td>A little bit</td>
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<tr>
<td>f)</td>
<td>Not at all</td>
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</table>

9. Have you been waking up fresh and rested during the past month?

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<tbody>
<tr>
<td>a)</td>
<td>Every day</td>
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<tr>
<td>b)</td>
<td>Most every day</td>
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<td>c)</td>
<td>Fairly often</td>
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<td>d)</td>
<td>Less than half the time</td>
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<td>e)</td>
<td>Rarely</td>
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<td>f)</td>
<td>None of the time</td>
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</table>

10. Have you been bothered by any illness, bodily disorders, pains, or fears about your health during the past month?

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<tbody>
<tr>
<td>a)</td>
<td>All the time</td>
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<tr>
<td>b)</td>
<td>Most of the time</td>
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<tr>
<td>c)</td>
<td>A good bit of the time</td>
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<td>d)</td>
<td>Some of the time</td>
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<tr>
<td>e)</td>
<td>A little of the time</td>
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<tr>
<td>f)</td>
<td>None of the time</td>
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</table>

11. Has your daily life been full of things that were interesting to you during the past month?

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<tbody>
<tr>
<td>a)</td>
<td>All the time</td>
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<tr>
<td>b)</td>
<td>Most of the time</td>
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<tr>
<td>c)</td>
<td>A good bit of the time</td>
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<tr>
<td>d)</td>
<td>Some of the time</td>
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<tr>
<td>e)</td>
<td>A little of the time</td>
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<td>f)</td>
<td>None of the time</td>
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12. Have you felt down-hearted and blue during the past month?

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<tbody>
<tr>
<td>a)</td>
<td>All of the time</td>
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<tr>
<td>b)</td>
<td>Most of the time</td>
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<tr>
<td>c)</td>
<td>A good bit of the time</td>
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<tr>
<td>d)</td>
<td>Some of the time</td>
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<tr>
<td>e)</td>
<td>A little of the time</td>
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<tr>
<td>f)</td>
<td>None of the time</td>
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</tbody>
</table>
13. Have you been feeling emotionally stable and sure of yourself during the past month?
   a) All of the time
   b) Most of the time
   c) A good bit of the time
   d) Some of the time
   e) A little of the time
   f) None of the time

14. Have you felt tired, worn out, used-up, or exhausted during the past month?
   a) All of the time
   b) Most of the time
   c) A good bit of the time
   d) Some of the time
   e) A little bit of the time
   f) None of the time

For each of the four scales below, note that the words at each end of the 0 to 10 scale describe opposite feelings. Circle any number along the bar which seems closest to how you have generally felt during the past month.

15. How concerned or worried about your health have you been during the past month?
   0 = not concerned at all
   10 = very concerned

16. How relaxed or tense have you been during the past month?
   0 = very relaxed
   10 = very tense

17. How much energy, pep, vitality have you felt during the past month?
   0 = no energy at all, listless
   10 = very energetic, dynamic

18. How depressed or cheerful have you been during the past month?
   0 = very depressed
   10 = very cheerful
NUMERICAL PAIN RATING SCALE:

RATE YOUR LEVEL OF PAIN ON THE SCALE, BY MARKING THE APPLICABLE BOX WITH A X

0 = No Pain
10 = Unbearable Pain

DORSOLUMBAR RANGES OF MOTION:

<table>
<thead>
<tr>
<th></th>
<th>DEGREES</th>
<th>PERCENTAGE IMPAIRMENT</th>
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<tbody>
<tr>
<td>FLEXION:</td>
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<td>EXTENSION:</td>
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<tr>
<td>RIGHT LATERAL FLEXION:</td>
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<tr>
<td>LEFT LATERAL FLEXION:</td>
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<tr>
<td>RIGHT ROTATION:</td>
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</tr>
<tr>
<td>LEFT ROTATION:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FORMULA 1A AND FORMULA 1B FOR MASSAGE OILS

Formula 1a: 10 ml almond oil
    4 drops chamomile essential oil
    6 drops lavender essential oil

Formula 1b: 10 ml almond oil
EFFLEURAGE MASSAGE FOR THE BACK

1. Put 1 - 2 teaspoons of massage oil in the palm of one hand. Rub both hands together lightly and spread the oil over the entire back and buttocks with wide sweeping movements.

2. Place hands at the base of the spine, fingers facing towards the shoulders all the time, and stroke firmly upwards alongside the spine, round the shoulder blade, then very lightly down the back, to the base of spine. Repeat 10 times.
   - see diagram 4.1 below

3. Put one hand over the other, and still starting at the base of the spine, push firmly up one side of the back to the shoulder area, where the hands cross the spine upwards between the shoulder blades, go right around the shoulder, cross upwards, and go right around the other shoulder (figure of 8 movement). Repeat 4 times, bringing hands back to the base of the spine on the last repeat. Keep the whole of the reinforced hand on the body.
   - see diagram 4.2 below

4. Repeat no. 2 5 times

5. With fingers facing towards the shoulders, on left side of the spine, move out towards the side of the body, opening the fingers whilst doing so. The next hand comes underneath the first one, and repeats the movement: each hand moves up the body a little
as well as going sideways like a fan. Finish at shoulder level. Repeat on the right side of the spine.
- see diagram 4.3 below

6. Using the thumbs, do friction circles from waist on either side of the spine, out and around the hip bone. Repeat 3 times, each time doing a smaller curve.
- see diagram 4.4 below

7. Repeat no.2 4 times

8. Repeat no.6 3 times

9. Repeat no.2 6 times
RANGE OF MOTION MEASUREMENTS CONVERSION TO PERCENTAGE IMPAIRMENT

(American Medical Association, 1983)

DORSOLUMBAR REGION

<table>
<thead>
<tr>
<th>Degrees of Dorsolumbar Motion</th>
<th>Impairment of Whole Man</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost</td>
<td>Retained</td>
</tr>
</tbody>
</table>

Restricted Motion

Average range of FLEXION—EXTENSION = 120 degrees
Value to total range of dorsolumbar motion = 40%

Flexion from neutral position (0°) to:

<table>
<thead>
<tr>
<th>Degrees</th>
<th>Lost</th>
<th>Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>90</td>
<td>0</td>
</tr>
<tr>
<td>10°</td>
<td>80</td>
<td>10</td>
</tr>
<tr>
<td>20°</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>30°</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>40°</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>50°</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>60°</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>70°</td>
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<td>70</td>
</tr>
<tr>
<td>80°</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>90°</td>
<td>0</td>
<td>90</td>
</tr>
</tbody>
</table>

Extension from neutral position (0°) to:

<table>
<thead>
<tr>
<th>Degrees</th>
<th>Lost</th>
<th>Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>10°</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>20°</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>30°</td>
<td>0</td>
<td>30</td>
</tr>
</tbody>
</table>

Average range of ROTATION = 60 degrees
Value to total range of dorsolumbar motion = 35%

Right rotation from neutral position (0°) to:

<table>
<thead>
<tr>
<th>Degrees</th>
<th>Lost</th>
<th>Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>10°</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>20°</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>30°</td>
<td>0</td>
<td>30</td>
</tr>
</tbody>
</table>

Left rotation from neutral position (0°) to:

<table>
<thead>
<tr>
<th>Degrees</th>
<th>Lost</th>
<th>Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>10°</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>20°</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>30°</td>
<td>0</td>
<td>30</td>
</tr>
</tbody>
</table>

Average range of LATERAL FLEXION (lateral bending) = 40 degrees
Value to total range of dorsolumbar motion = 25%

Right lateral flexing from neutral position (0°) to:

<table>
<thead>
<tr>
<th>Degrees</th>
<th>Lost</th>
<th>Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>10°</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>20°</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

Left lateral flexing from neutral position (0°) to:

<table>
<thead>
<tr>
<th>Degrees</th>
<th>Lost</th>
<th>Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>10°</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>20°</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>