



**EFFECT OF YOGA AND NATUROPATHY ON PHYSICAL,
BIOCHEMICAL, IMMUNOLOGICAL AND INFLAMMATORY
PARAMETERS IN PATIENTS SUFFERING FROM RHEUMATOID
ARTHRITIS**

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ABSTRACT :

Aim: Present study was aimed to find out the effect of yoga and naturopathy, that has gained tremendous magnitude in recent times, on morning stiffness, joint swelling, routine biochemical parameters, ESR, RA factor and serum IL -6 levels in patients suffering from rheumatoid arthritis.

Materials and Methods: Total of Seventy five rheumatoid arthritis patients were enrolled and divided in two groups. Control group included 36 patients taking allopathic medication. Treatment group included 39 patients taking yoga (pranayama and asanas) and naturopathy (hot and cold fomentation and message therapy) along with allopathic medication. Morning stiffness, joint swelling along with routine biochemical parameters, ESR, RA factor and serum Interleukin-6 (IL-6) levels were estimated in both the groups.

Results: Results are expressed as mean \pm SD. Student's paired t test (two-tailed) from baseline to 12 months was computed. There was a significant reduction in morning stiffness and joint swelling in treatment group ($p<0.001$) as compared to control group ($p<0.05$). Reduction in RA factor was only in treatment group ($p<0.001$). No significant effect was observed on liver function tests (LFT) and kidney function tests (KFT). In treatment group significant reduction was observed in ESR group ($p<0.05$) and serum IL -6 ($p<0.001$).

Conclusion: Significant reduction in morning stiffness, joint swelling, ESR, RA factor and levels of IL-6 in patients who undertook regular yoga and naturopathy in addition to allopathic treatment emphasizes the importance of natural healing measures in order to limit inflammation in RA.

Key words: Rheumatoid arthritis (RA), Rheumatoid factor (RF), Eosinophil sedimentation rate (ESR), morning stiffness (MS), Interleukin-6 (IL-6)

INTRODUCTION: Rheumatoid arthritis is a chronic illness characterized by inflammation of joints and surrounding tissues. It is an autoimmune disorder in

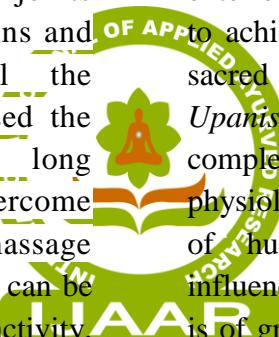
which immune system targets the healthy tissue of the body. The condition occurs due to inflammation of linings of joints which is accompanied by swelling and possible deformity of joints ⁽¹⁾. Causes of Rheumatoid arthritis disease are unknown. The disease may be linked to hormones, infection and genes. Women like other autoimmune diseases are more prone to RA ⁽²⁾.

Rheumatoid arthritis results in inflammation inside the body, and the only way to reduce inflammation is to adopt an anti inflammatory lifestyle. Hence, treatment cannot be restricted only to diet or one form of science. Some specialised plan may include mild yoga to keep the joints supple, Pranayama to release toxins and stress, supplements to fulfil the nutritional deficiencies that caused the compromised immune system, long periods of rest and sleep to overcome fatigue, and may be Ayurvedic massage to repair joint damage. Treatment can be planned according to disease activity, types of joints involved, general health and age of the person. Consistently attacking RA for 2-3 months at a stretch reverses it, reducing the inflammation and the pain. Even though there is tendency to give rest to the painful joints but prolonged resting may increase the pain. Research suggests that more intense exercise may not only be safe, but may actually produce greater muscle strength and overall functioning ⁽³⁾. Also painkillers maybe of little help, which is why the main aim of the present study was to interrupt the inflammatory symptoms associated with the advancement of joint deterioration and to minimize the occurrences of intense

pain episodes with the help of yoga and naturopathy.

Yoga is characterized as a science of self-study and awareness through 'asanas' (body postures), 'pranayama' (patterns of breathing) and meditation. The ultimate goal of this practice is the achievement of harmony in body, mind and spirit. The main goal of yoga is helping individuals to realize true happiness, freedom, and enlightenment. Beyond this, however, yoga has several secondary goals, such as improving physical health and enhancing mental well-being and emotional balance ⁽⁴⁾. Yoga is one of the best types of exercises for treatment of RA. Yoga has been used as a means to explore the exterior and interior world and ultimately to achieve wisdom and knowledge of the sacred Indian texts: the *Vedas*, *Upanishads*, and *Shastras* ⁽⁵⁾. It forms a complete exercise plan involving physical, physiological and psychological faculties of human being which significantly influences the musculo-skeletal system and is of great help for persons suffering from chronic illnesses. Pain management strategies considered in this study was Pranayama.

Naturopathy is a system of treatment of disease that avoids drugs and surgery and emphasizes the use of natural agents i.e air, water, herbs and physical means. Evidence for the effectiveness of alternative medicines in rheumatoid arthritis is inconclusive as studies are often too small and are of short duration. Nevertheless, there is some evidence that certain supplements and natural therapies could have a role in managing the disease ⁽⁶⁾. In this study one of the pain management strategies considered was massage therapy, which may be of help for



manually controlling symptoms in people suffering from RA. Thermotherapy is also commonly used in treating rheumatoid arthritis ⁽⁷⁾. Thermotherapy modality included for this study was Fomentation Therapy- a form of Hydrotherapy - Hot and Cold water applications.

Keeping in view the aforesaid, the present study was planned to find out therapeutic potential of yoga and naturopathy for one year in patients suffering from RA. The effect was evaluated by studying the parameters morning stiffness, joint swelling, RA factor, ESR, LFT, KFT and IL-6. The goal of treatment was to study the regression of symptoms like joint swelling and morning stiffness.

MATERIALS AND METHODS: The study was conducted in department of research, Bapu Nature Cure Hospital in collaboration with department of Biochemistry, GB Pant Hospital. A total of Seventy five radiologically and serologically proven RA patients were enrolled and divided in two groups. Group 1, the control group included 36 patients taking allopathic medication Group 2, the treatment group included 39 rheumatoid arthritis patients taking naturopathy, yoga and allopathic medication. Written consent was taken from all the patients and ethical guidelines were followed during the study. The study had due approval from ethical committee of the institution. Rheumatoid arthritis patients satisfying the American College of Rheumatology criteria for rheumatoid arthritis were recruited by inclusion and exclusion criteria (Guidelines for the management of rheumatoid arthritis, 2002 update)⁽⁸⁾. After baseline investigation patient were given intensive information, education and counselling about risk factor of the disease

and importance of yoga and naturopathy. After their awareness and counselling about the disease, yoga and naturopathy modalities were administered to patients.

Inclusion criteria: Patients of both the sex aged 25 to 60 years. Diagnosed patients of Rheumatoid Arthritis (RA) and satisfying the American College of Rheumatology criteria since past six weeks at least.

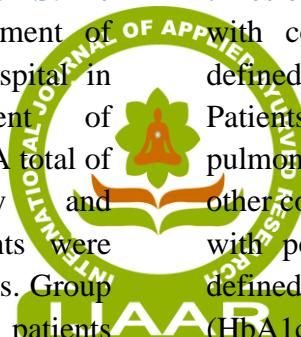
Exclusion Criteria: Following patients were excluded from the study:

1) Patients having a past history of Severe Cardiac dysfunction (atrial fibrillation, Heart failure, myocardial infarction, uncontrolled hypertension, or stroke. 2) Patients with concurrent serious hepatic disorders defined as AST and/or ALT > 3 times of the upper normal limit. 3) Patients with concurrent serious renal disorders defined as serum creatinine > 4.0 mg/dl. 4) Patients with concurrent serious pulmonary dysfunction. 5) Patients with other concurrent severe diseases. 6) Patient with poorly controlled diabetes mellitus defined as Glycosylated haemoglobin (HbA1c) $> 10\%$. 7) Patient with cerebrovascular event during the last 12 months. 8) Women who are pregnant or lactating. 9) Alcoholics. 10) Drug abusers. 11) Patient with history of malignancy within past 2 years.

TREATMENT

1) Naturopathy Treatment⁽⁹⁾

a) Massage: patients were provided massage to the affected parts using warm sesame oil having anti-inflammatory properties (50 ml per sitting) for 30 minutes. The techniques used were stroking, friction, kneading, percussion and vibration. Massaging directly to the inflamed joint was avoided in the treatment course. During inflammation massage was given to the areas which



were above and below the affected joints to reduce inflammation.

b) Hot and cold fomentation was provided to every patient for 11 minutes – hot fomentation for 5 minutes and cold fomentation for 30 seconds for two rounds. This was followed by a heating compress (using a dry cotton cloth and woollen flannel) for 10 minutes. The temperature of both hot fomentation (40°- 45 °C) and cold fomentation (18°- 26 °C) was controlled well during the treatment period. The duration of cold therapy was less than heat therapy. This was because effect of cold is known to last longer than heat.

2) Yoga Therapy: The yoga therapies (20 min), practiced were Pawanmuktasana part I (anti-rheumatic), Shavasana and Pranayama (Bhramari, Kapalbati, Deep breathing and Nadi sodhana) (Gheranda Samhita).

The total treatment period for each patient was one year. Therapies were administered thrice a week on alternate days for first two months (1-2) then followed by twice in a week for the next four months (3-6) and in last six months (7-12) once a week. On days without session, patients were advised to continue this practice for 20-25 minutes at home. The daily adherence to this program was evaluated by analyzing questionnaire that was collected every month. The treatment was modified or omitted to avoid strain, whenever there was any inflammation in the joints. Yoga and naturopathy therapist followed the specific recommendations of orthopaedic surgeon for safe and healthy execution of treatment.

3) Allopathic Medicines: For delay in progression of RA, allopathic treatments were used in conjunction with yoga and

naturopathy regime. The prescribed disease modifying drugs were Methotrexate, Sulfasalazine and Hydroxy chloroquine. For better management of the disease conditions, drugs like calcium and folate were also administered as per specific requirement. The doses were kept stable and the participants were asked to consult rheumatologists at the end of every month to review the medication. Principles of treatment remained same in both the groups and doses were modified according to the activity of disease.

PARAMETERS STUDIED:

Physical parameters

a) Morning stiffness- In our study morning stiffness of the patients was noted from 0 (no morning stiffness) to 10 (severe morning stiffness) scale ⁽¹⁰⁾. Patients were categorized according to their response: mild (rating of 1-3), moderate (4-7) and severe (8-10) morning stiffness.

b) Joint swelling - Swollen joints of the patients were scored on a 0-3 scale such as 3- severe, 2-moderate, 1-mild and 0-normal ⁽¹¹⁾. This was based on observation and palpation.

Biochemical parameters: Blood chemistry was used to determine physiological and biochemical states and organ function. Following serum test of patients were estimated spectrophotometrically.

-Liver function tests- Serum Glutamate oxaloacetic transferase (SGOT), Serum Glutamic Pyruvic Transaminase (SGOT), alkaline phosphatase (ALP), Total Protein, Albumin, Total Bilirubin.

-Kidney function tests- Urea, Creatinine

Immunological marker:

RA factor Rheumatoid factor (RF) - The blood samples were taken for Rheumatoid factor (RF) prior to the intervention and after a period of 12 months ⁽¹²⁾



Inflammatory markers:

Erythrocyte Sedimentation Rate (ESR): - was measured by Westergren and Wintrobe Methods⁽¹³⁾

Interleukin 6 (IL-6) levels were estimated in both groups using commercially available ELISA kits (Dichrome).

OBSERVATION AND RESULTS:

TABLES

Table 1: Values of physical parameters Joint swelling, Morning stiffness, in control and treatment (Naturopathy and yoga) group before and after a period of 12 months

Variable in degrees	Assessment	Control group (MEAN \pm SD)	Treatment group (MEAN \pm SD)
Joint swelling (0-3 numerical value scale)	Before	2.1 \pm 0.7	2 \pm 0.6
	After 12 months	1.6 \pm 0.97*	0.74 \pm 0.64***
	P value	0.015	<0.000001
Morning stiffness(0-10 cm scale)	Before	5.33 \pm 1.79	5.01 \pm 2.03
	After 12 months	3.94 \pm 2.19*	1.89 \pm 2.06***
	P value	0.0043	<0.000001

*p < 0.05, **p < 0.01, ***p < 0.001

Table 2: Values of inflammatory markers (ESR and IL6) and immunological marker (RA factor) and in control and treatment (Naturopathy and yoga) group before and after a period of 12 months

Variable in degrees	Assessment	Control group (MEAN \pm SD)	Treatment group (MEAN \pm SD)
ESR(mm/hr)	Before	44.92 \pm 29.11	47.41 \pm 25.39
	After 12 months	36.61 \pm 17.01	35.92 \pm 18.19*
	P value	0.143	0.024
IL6(pg/ml)	Before	4.30 \pm 3.90	5.45 \pm 3.92
	After 12 months	3.30 \pm 4.15	2.82 \pm 2.56***
	P value	0.294	0.000766
RA factor(U/ml)	Before	120.94 \pm 93.99	174.72 \pm 120.05
	After 12 months	127.06 \pm 91.79	111.82 \pm 79.63***
	P value	0.598	0.000

*p < 0.05, **p < 0.01, ***p < 0.001

Table 3: Values of Biochemical parameters in control and treatment (Naturopathy and yoga) group before and after a period of 12 months

Parameter	Assessment	Control group	Treatment group
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		(MEAN \pm SD)	(MEAN \pm SD)
T Bil (mg/dl)	Before	0.59 \pm 0.18	0.63 \pm 0.22
	After 12 months	0.56 \pm 0.21	0.55 \pm 0.25
	P value	0.473	0.153
T Protein (gm/dl)	Before	7.11 \pm 0.69	7.06 \pm 0.63
	After 12 months	7.22 \pm 0.62	7.12 \pm 0.58
	P value	0.496	0.680
Albumin(gm/dl)	Before	3.90 \pm 0.55	3.94 \pm 0.34
	After 12 months	4.06 \pm 0.47	3.98 \pm 0.27
	P value	0.196	0.524
SGOT(U/L)	Before	32.94 \pm 25.45	30.67 \pm 13.87
	After 12 months	28.94 \pm 12.42	29.44 \pm 10.21
	P value	0.399	0.656
SGPT(U/L)	Before	23.25 \pm 10.61	28.62 \pm 16.64
	After 12 months	26.39 \pm 14.60	26.97 \pm 13.73
	P value	0.300	0.636
ALP(U/L)	Before	101.50 \pm 24.26	102.26 \pm 29.14
	After 12 months	106.47 \pm 29.05	91.92 \pm 22.04
	P value	0.433	0.081
Urea(mg/dl)	Before	23.97 \pm 6.50	22.69 \pm 7.24
	After 12 months	26.25 \pm 6.13	24.97 \pm 10.33
	P value	0.130	0.262
Creatinine(mg/dl)	Before	0.91 \pm 0.15	0.88 \pm 0.15
	After 12 months	0.85 \pm 0.19	0.84 \pm 0.24
	P value	0.144	0.370
Uric acid(mg/dl)	Before	4.46 \pm 1.64	4.85 \pm 1.45
	After 12 months	4.77 \pm 2.14	4.93 \pm 1.41
Hb (gm/dl)	Before	11.37 \pm 1.72	11.90 \pm 2.06
	After 12 months	11.35 \pm 1.13	11.71 \pm 1.30
	P value	0.948	0.626

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A significant reduction in Joint swelling and Morning stiffness ($p < 0.05$) was found in control group taking allopathic treatment. On the other hand a very significant reduction in Joint swelling and morning stiffness ($p < 0.001$) was seen in the treatment group (Table1).

Levels of ESR were statistically lower only in treatment group ($p < 0.05$). Values

for IL6 showed significant reduction ($p < 0.001$) in the treatment group. RA factor (U/ml) reduction observed only in treatment group was also highly significant ($p < 0.001$) (Table 2).

There was no significant change in the Liver and kidney function tests in any of the two groups (Table 3).

DISCUSSION: Naturopathy and yoga exercises that are less traumatic for the joints can be beneficial in maintaining flexibility and strength in RA patients. While traditional guidelines have restricted RA patients to only gentle exercise, research suggests that more intense exercise may not only be safe, but may actually produce greater muscle strength and overall functioning ⁽¹⁴⁾ and does not exacerbate pain or worsen the disease ⁽¹⁵⁾. The present study of one year of naturopathy and yoga for RA was able to demonstrate statistically significant reduction in morning stiffness and joint swelling. In treatment group there was a significant reduction in immunological marker, RA factor and inflammatory markers, ESR and serum IL -6. No significant effect was observed on LFT and KFT levels. The patients had good relief in pain, swelling and stiffness of muscles. This shows that natural healing measures can control inflammation in RA patients. Some patients in the treatment group were able to decrease or discontinue allopathic medications. Combinations of medications with naturopathy and yoga can provide important additional physical and psychological health benefits and help in the better management of chronic rheumatoid arthritis condition in a scientific manner. The findings emphasize importance of natural healing measures in order to limit inflammation in RA.

Any type of stress, acute or chronic, has impact on the immune system. The present study included yoga therapy as the psychological benefits of yoga such as stress reduction contribute to greater overall health. According to a study nearly 75% to 90% of visits to a primary care physician are related to stress and anxiety.

In addition to generalized anxiety and sleep disorders, it can result in significant physiological problems, including cardiovascular, gastrointestinal and immunological ⁽¹⁶⁾. Yogic techniques involve isometric contraction which is known to increase skeletal muscle strength and reduce stress and anxiety, improve autonomic functions by triggering neurohormonal mechanisms by the suppression of sympathetic activity ⁽¹⁷⁾. Studies indicate that yoga may serve as a valuable adjunctive therapy for improving physical function, pain, disability index and mental wellness, among individuals with rheumatic disease ^{(18) (19)}. Research evidence supports the belief that certain yoga techniques may improve physical and mental health through down-regulation of the hypothalamopituitary adrenal (HPA) axis and the sympathetic nervous system. ⁽²⁰⁾

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positively affect the physiological systems of a patient with RA and help to alleviate and prolong the deteriorating effects of the disease⁽²⁶⁾. Research showed that adults with RA may feel a decrease in pain, as well as greater grip strength and range of motion in wrists and large upper joints, after receiving regular moderate-pressure massages for a 4-week period⁽²⁷⁾.

Fomentation therapy was part of the Naturopathy treatment in our study. With its help the blood is stimulated and revitalized and white blood cells increase. When the heat is applied, the blood vessels dilate and with the cold they contract. This action causes the blood to surge back and forth, increasing the flow and stimulating stagnant blood and lymph. When this happens, the healthy blood cells are concentrated in the activated area⁽²⁸⁾. The Increased blood flow delivers oxygen and nutrients, and removes cell wastes. The warmth decreases muscle spasm, relaxes tense muscles, relieves pain and can increase range of motion. Cold therapy produces vasoconstriction, which slows circulation thereby reducing inflammation, soreness, muscle spasm, pain and temporarily relieving joint pain caused by an arthritis flare. It has been found that cold compression therapy improves the control of pain and might thus lead to improvement in range of movement⁽²⁹⁾. Patients experience a reduction in pain complaints, improved mobility, reduced pharmaceutical use and an overall better impression of the health care system. Additional reasons being the desire for more comprehensive treatment with fewer side effects⁽³⁰⁾.

With yoga and naturopathy improvement in stiffness of joints was observed in our study. Morning stiffness in RA can be

attributed to the disrupted circadian rhythm of pro-inflammatory cytokine release in RA⁽³¹⁾. As a consequence, symptoms that follow the circadian rhythm like joint stiffness and pain are most severe in the early mornings⁽³²⁾. In our study there was a significant decreased in release of the pro-inflammatory cytokine IL-6 in the treatment group as compared to control group. Joint stiffness in RA has been associated with increased secretion of the pro-inflammatory cytokine IL-6, suggesting that clinical symptoms may be related to hormonal and immune circadian variations. Study by Jessop proposes that these changes in IL-6 and cortisol, prior to the onset of morning joint stiffness, are functionally important in RA patients⁽³³⁾. This may point to the need for considering of anti-IL-6 agent or alternative therapy which can decrease secretion of the pro-inflammatory cytokine IL-6, in the management plan of RA patients.



CONCLUSION: After yoga and naturopathy a significant decrease of morning stiffness, joint inflammation, and ESR and IL-6 levels were observed. Yoga and naturopathy practice, if done regularly, can help RA patients cope with pain and can result in overall improvement.

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REFERENCES:

1. Hochberg MC. Adult and juvenile rheumatoid arthritis- Current epidemiologic concepts. Epidemiol Rev. 1981; 3:27-44
2. DeLisa Fairweather, Sylvia Frisancho-Kiss, and Noel R. Rose Sex Differences in Autoimmune Disease from

a Pathological Perspective. *Am J Pathol.* 2008 Sep; 173(3): 600–609.

3. Lineker SC, Bell MJ, Wilkins AL, Badley EM. Improvements following short term home based physical therapy are maintained at one year in people with moderate to severe rheumatoid arthritis. *J Rheumatol.* 2001; 28(1):165-168

4. Yoga Research and Education. 2003. www.yrec.org

5. Feuerstein G. *Yoga: The Technology of Ecstasy.* Los Angeles, Jeremy P. Tarcher. 1989 pp 11-16

6. Vitetta L, Cicuttini F and Sali A. Alternative therapies for musculoskeletal conditions. *Best Practice & Research: Clinical Rheumatology.* 2008; 22:499–522.

7. Robinson V, BrosseauL, CasimiroL, Judd M, Shea B, Wells G, Tugwell PCochrane Database Syst Rev. Thermotherapy for treating rheumatoid arthritis 2002;(2):CD002826.

8. American College of Rheumatology Subcommittee on Rheumatoid Arthritis. Guidelines for the management of rheumatoid arthritis. 2002 update. *Arthritis.Rheum.* 2002; 46:328-346

9. Kellogg JH. A manual of the physiological and therapeutic effects of hydriatic procedures, and the technique of their application in the treatment of disease. *Rational hydrotherapy*, 1918

10. Phillips S., Dow L., Impact of impaired morning function on quality of life in rheumatoid arthritis: results of an exploratory patient survey. *Int. J. Clin. Rheumatol.* 2012; 7(6): 675-682

11. Thompson, P.W., Silman, A.J., Kirwan, J.R., Arthicular Indices of joint Inflammation in Rheumatoid Arthritis, *Arthritis Rheum*, 1987; 30(6) : 618-623.

12. Hermann, E; Vogt, P; Müller, W. Rheumatoid factors of immunoglobulin classes IgA, IgG and IgM: Methods of determination and clinical value. *Schweizerische medizinische Wochenschrift.* 1986; 116 (38): 1290–1297

13. David Gilmour and A. J. Sykes Westergren and Wintrobe Methods of Estimating E.S.R. Compared**Br Med J.* 1951 Dec 22; 2(4746): 1496–1497.

14. Lineker SC, Bell MJ, Wilkins AL, Badley EM. Improvements following short term home based physical therapy are maintained at one year in people with moderate to severe rheumatoid arthritis. *J Rheumatol.* 2001; 28(1):165-168.

15. Bearne LM, Scott DL, Harley MV,  Exercise can reverse quadriiceps sensorimotor dysfunction that is associated with Rheumatoid Arthritis without exacerbating disease activity, *Rheumatology.* 2002; 41(2):157-166

16. Kathleen A. Head, ND and Gregory S. Kelly, ND. Nutrients and Botanicals for Treatment of Stress: Adrenal Fatigue, Neurotransmitter Imbalance, Anxiety and Restless Sleep. 2009; 114 – 139

17. Sengupta P. Health Impacts of Yoga and Pranayama: A State-of-the-Art Review *Int J Prev Med.* 2012; 3(7): 444–458.

18. Matthew C Sullivan BA, Elena Manning BS and Raveendhara R Bannuru Yoga for Rheumatic Conditions: Potential Physical, Cognitive and Affective Advantages *J Yoga Phys Ther.* 2014; 4: 2

19. Evans S, Moieni M, Lung K, Tsao J, Sternlieb B, Taylor M, Zeltzer L: Impact of iyengar yoga on quality of life in young women with rheumatoid arthritis. *Clin J Pain.* 2013; 29(11):988-997.

20. Innes KE, Bourguignon C, Taylor AG. Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with yoga: A systematic review. *J Am Board Fam Pract.* 2005; 18:491–519.

21. Prekumar K. *The Massage Connection: Anatomy and Physiology.* Baltimore: Lippincott, Williams & Wilkins. 2004

22. O'Brien M. *Therapy Database: Rheumatoid Arthritis.* Accessed Sept. 1, 2006 www.altguide.com/therapydata/rheumatoid.html.

23. Field T, Diego M, Hernandez-Reif M, Shea J. Hand arthritis pain is reduced by massage therapy. *Journal of Bodywork and Movement Therapies.* 2007; 11:21–24.

24. Wine Z. K. Russian medical massage: arthritis. (electronic version) *Massage Magazine.* 1995; 57:90–92.

25. Osborn K. Chasing the pain away. (electronic version) *Massage & Bodywork,* 2005; 20(3):138–143.

26. Robin B. Anderson. Researching the Effects of Massage Therapy in Treating Rheumatoid Arthritis. *Massage Today.* December, 2007; 7(12)

27. Field T, Diego M, Delgado J, Garcia D, Funk CG, *Rheumatoid Arthritis in Upper Limbs Benefits from Moderate Pressure Massage Therapy. Complementary Therapies in Clinical Practice.* 2013 May; 19(2):101-3.

28. Darrin k. Poitras. Hot and cold towel therapy – fomentations <https://youtube/7pcmm3ott13 Nov 2013>

29. Kullenberg B, Ylipää S, Söderlund K, Resch S *Postoperative cryotherapy after total knee arthroplasty: a prospective study of 86 patients.* *J Arthroplasty.* 2006; 21(8):1175–9.

30. Peter Kooreman and Erik Baars. Patients whose GP knows complementary medicine tend to have lower costs and live longer. May 2011; 1-18

31. Straub RH, Cutolo M: Circadian rhythms in rheumatoid arthritis: implications for pathophysiology and therapeutic management. *Arthritis Rheum* 2007, 56:399–408.

32. Cutolo M, Seriolo B, Craviotto C, Pizzorni C, Sulli A: Circadian rhythms in RA. *Ann Rheum Dis.* 2003, 62:593–6.

33. D. Jessop. IL-6, Cortisol and early morning stiffness in patients with rheumatoid arthritis: endocrine changes associated with clinical improvement in a chronic autoimmune disease *Endocrine Abstracts.* 2012; 29:1554

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Declared