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Exercise Therapy and Musculoskeletal Disorders

Rheumatoid Arthritis, Osteoarthritis and Back Pain

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# Contents

Guidelines . . . . .	v
Introduction . . . . .	vii
1. Exercise Therapy in Rheumatoid Arthritis and Osteoarthritis. . . . .	1
2. Exercise Therapy and Back Pain . . . . .	25
3. Rheumatic Diseases and Back Pain in relation to Sports . . . . .	51
4. Miscellaneous . . . . .	67
Authors Index . . . . .	81
Subject Index . . . . .	93
NIVEL Bibliographies . . . . .	99

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## Guidelines

The literature has been gathered from the (computerized) catalogues of Medline (Index Medicus), the Nivel library, the university of Utrecht (RUU), the university of Groningen (RUG) and the Royal Netherlands Academy of Sciences Library (KNAW). The title description of each article included contains a reference to the library where the article can be found, for example 'RUU' refers to the Utrecht University Library. 'Nivel' refers to the Nivel Library (in which case a catalogue number is added). Naturally, publications can also be found in other libraries. In each chapter the publications are ordered alphabetically. The author index and the subject index are added to retrieve literature via these entries.

Most of the articles in this bibliography were written over the past ten years, but some important publications of earlier years are also included. The first chapter concerns the relatively new approach of exercise therapy in patients with rheumatoid arthritis and osteoarthritis. Chapter Two deals with exercise therapy for patients with (low) back pain. In a sense this subject matter is discussed from another point of view in chapter Three. Here the interest is focussed upon the influence of sports and activity on the onset of rheumatic diseases and back pain. Finally, a variety of publications, more or less related to the former subjects, have been gathered in the last chapter.

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## Introduction

Among the rheumatic diseases there are several which affect the musculo-skeletal system. **Rheumatoid Arthritis** refers to the manifestation of rheumatic disorders in the joints, characterized by inflammation in the synovial lining of the joints resulting in cartilage and bone destruction. The cardinal symptom is pain attended with swelling and stiffness of especially the peripheral joints.

Recent epidemiological data indicate that in most adult western countries, rheumatoid arthritis, has a prevalence of about 1%. The disease usually appears at the ages between 20 and 40 and leads to an accumulation of patients among the elderly. The precise causes of the disease are unknown until now. Nevertheless, it is presumed that persons with a certain tendency towards getting rheumatoid arthritis, who are exposed to primary causal agents (antigens), may develop rheumatoid arthritis because of a deviant reaction of the immunosystem.

Of all the rheumatic diseases, **osteoarthritis** is the most prevalent one, particularly among elderly people. Osteoarthritis refers to a process of multifactorial etiology which is not yet well understood and leads to cartilaginous degeneration. Among the various factors that are important in pathogenesis are genetic predisposition, trauma, inflammation, biochemical and metabolic pathways, possibly immunologic events, environmental influences and recreational factors. A painful range of motion, morning stiffness, crepitation, and bony enlargement are important clinical features.

In osteoarthritis the pain comes in spells that may last for days, weeks or months, although relative remissions of variable duration may occur. In the early stages of the disease affecting the back and the lower limbs, the pain is essentially limited to the weight bearing joints. Ultimately, the pain is also present at rest and interferes with sleep. Pain, weakness and instability of the knee as well as pain and restriction of hip motion compromise getting up from rest, walking and standing for any length of time.

Osteoarthritis can result in decreased strength in the periarticular muscles of the involved joint, decreased flexibility, weight gain, and a decreased aerobic capacity. These deficits are probably the result of a decreased use of the joint due to pain, effusion, and/or limitation of motion from bony changes. Reduced physical activity would also explain the decreased aerobic capacity and exercise endurance noted in patients with osteoarthritis as compared with healthy aged-matched controls.

In spite of the absent etiological knowledge, some modes of **treatment** have been evaluated. The most important goal to be attained is a decrease of pain and inflammation, preservation of function and the prevention of deformations. Even though there are anti-inflammatory drugs, pharmacologic therapy is not curative. As a matter of fact there is no curative treatment. For this reason conservative treatment, which doesn't show undesirable side-effects,

is often preferable to more spectacular methods. This treatment is a combination of rest, exercise and the use of analgetics. These measures form the basis for more specialistic methods of treatment.

Of course, the choice of therapy largely depends on the nature of the disease, but also on the severeness of the rheumatic complaints. The American Rheumatic Association classifies patients on the basis of their functional capacity, as follows:

class 1: complete capacity, i.e. being able to carry out all usual duties without handicap.

class 2: capacity adequate to conduct normal activities despite discomfort or limited mobility of one or more joints.

class 3: capacity adequate to perform only a few, if any, duties of care.

class 4: largely or wholly incapacitated, i.e. bedridden or confined to a wheelchair, permitting little or no self-care.

Over the last decennia the application of **exercise therapy** has become more popular especially for those patients belonging to class 2 or 3 of the above mentioned classification. In the past, in cases of weakness and fatigue, physicians often recommended further reduction of physical activity. Their ideas were justified by a belief in the anti-rheumatic benefit of rest. As said before it is still generally believed that rest is an important factor, but on the other hand, physical activity is essential to maintain the functions of the locomotor system. Moreover, muscular weakness and low endurance, caused by inactivity and disease-related processes such as a reduced blood-flow, are very common in rheumatoid patients. This may lead to an increased viscosity of the blood, which in turn increases the risk of a heart attack. Most patients also develop decalcification of the bones often resulting in fragility and fractures, which might be caused by a lack of physical activity. Still, further research is needed to confirm this.

Nowadays the trend is toward less rest and more activity. Also because of research over the past decennia that suggest that **exercise** is not as detrimental as was previously believed. Now it is thought that patients should be able to perform exercises without any adverse effects on the joints. **Aerobic fitness** in particular can be improved through participation in these exercise programs. Several studies showed that the aerobic capacity in rheumatoid patients is substantially smaller than in healthy persons. After improving this capacity by means of training, patients seem to show less stiffness and are better able to cope with their diseases because of a greater endurance and a greater sense of well-being. Virtually all investigators claim to improve the aerobic ability without exacerbation of joint disease.

Therapeutic exercise is aimed not only at improving the physical endurance of rheumatoid patients, but also at improving flexibility and muscle strength. There is a variety of exercises and many factors must be taken into account when choosing an exercise program, e.g. the assessment of local and systemic involvement, the stage of the patient's disease, the cause of the pain, the age of the patient, the level of compliance with exercise, etc.

After an inventory a program can be designed with passive or active exercise (i.e., exercise performed by another person or a device or by the patient himself), isotonic and/or isometric exercise (i.e., static contraction of muscle in which tension is generated against a fixed object, or exercise by lengthening and shortening muscles), stretching and range of motion exercises and endurance exercises like aerobic dancing, running, swimming or cycling. In the last years different forms of exercise have been evaluated. Also the use of swimming pools and bicycles has been studied.

It has been postulated that running or, more generally, **sports** in which a lot of weight is put on the joints might accelerate the development of osteoarthritis and disability. But there are no data to support the concern that practising a sport will make the onset of arthritic joints more likely. Recent studies even claim that runners have less disability compared with matched control subjects. One possible explanation is that running can slow the rate of musculoskeletal functional loss with aging.

What is clear after all is that sports which include repeated stress and strain, particularly angular and torsional, are associated with an increased prevalence of enthesopathic lesions. Such sports, most particularly those which include collision or the possibility of uncontrolled movement, generate an excess of acute joint injuries such as meniscal and ligamentous disruption.

All the above mentioned subjects are of a rheumatoid nature. **Low back pain**, which a lot of people suffer from, is not necessarily caused by rheumatoid disorders but can hardly be missed in a discussion about exercise therapy.

The diagnosis and treatment of back pain is a controversial subject in medicine today. Serious doubts exist about the accuracy of the current assessment of etiology and consequently also about the use of therapeutic exercise, because knowledge of the various causes of low back pain is needed for a better understanding of the role of certain exercises in the treatment of this disorder. Nevertheless, there is some clinical evidence that therapeutic exercise may play an important role in the elimination of low back pain. However, a thorough scientific basis is lacking, which means that the selection of an exercise program is in fact often conducted on the basis of empirical knowledge.

Epidemiological studies suggest a high level of significance for the three combined factors of body weight, smoking and a decreased physical activity with respect to the occurrence of low back pain. For this reason, clinicians agree that the use of exercise is rather important in the treatment and prevention of low back pain. There is no absolute evidence that fitness training will prevent low back pain, but what is clear, is that the muscular endurance in especially the lumbar extensor muscles found in patients with low back pain is very low. Most exercise programs therefore pay a lot of attention to the strength, flexibility and endurance of the muscles.

The importance of aerobic fitness is related to the importance of general fitness. Aerobic exercises are not intensive enough to increase the strength of the muscles but will prevent deconditioning and excessive weight gain, thereby decreasing the risk for further low back pain and injuries. It has also been hypothesized that participation in aerobic exercises might increase  $\beta$ -

endorphin levels which causes a reduced pain experience. However, the exact mechanism is not very well understood.

From what precedes it may be concluded that exercise in the treatment of rheumatoid diseases and low back pain becomes more and more popular among physicians. Especially the use of aerobic exercise in (osteo)arthritis has been studied and evaluated over the past years. The history of exercise for patients with low back pain goes back to earlier years. This bibliography wants to give an overall picture of recent literature concerning exercise therapy in rheumatoid diseases as well as low back pain.

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Baltimore: Williams & Wilkins, 1984.

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Exercise testing and exercise prescription for special cases.  
Philadelphia: Lea & Febiger, 1987.

## 1. Exercise Therapy in Rheumatoid Arthritis and Osteoarthritis.

ALLEN, M.E.

Arthritis and adaptive walking and running.

Rheumatic Disease Clinics of North America; 16, 1990, 4, p. 887-914, 174 ref.

Nivel (C 3604)

No longer is rest or inactivity a password for arthritis. Patients with arthritis are now being encouraged to walk and run. It's part of the exercise continuum that imparts health to many components of the body, including the joints and their support tissues. Joint impact loads during running are less of a concern, whereas flexibility as a shock absorber is more important. The debate on immobilization versus mobilization definitely has shifted to the latter. Much has been learned from sports medicine, which can turn a rheumatologist into a "coach."

BARDWICK, P.A., SWEZEY, R.L.

Physical therapies in arthritis

Postgraduate Medicine; 72, 1982, no. 3, p. 223-234, 4 ref.

Nivel (C 3605)

In arthritis it may be the case that a prescription for physical therapy that is therapeutic rather than palliative requires more knowledge of the art of medicine than of science. Thermal, electrical, and exercise therapy can all be useful, and the physician should not hesitate to consult with a physical therapist in devising an appropriate program.

BASMAJIAN, J.V.

Therapeutic exercise in the management of rheumatic diseases.

The Journal of Rheumatology; 14, 1987, Suppl 15, p. 22-25

KNAW

In spite of the wide use of therapeutic exercise in the management of musculoskeletal diseases such as chronic arthritis, there are few controlled studies that establish its effectiveness. Only active contraction can increase muscle strength. Exercises in the horizontal plane or of limbs supported by the buoyancy of water can be carried out with relative ease by people with weak muscles or painful joints. The benefits of exercise programs can be classified as improving general fitness, increasing joint mobility and recondi-

tioning. Whether the large amount of money taht is currently being spent on exercise programs is truly cost-effective is an important question relating to health policy, and requires an answer.

BEALS, C.A., LAMPMAN, R.M., BANWELL, B.F., BAUNSTEIN, E.M., ALBERS, J.W., CASTOR, C.W.  
Measurement of exercise tolerance in patients with rheumatoid arthritis and osteoarthritis.  
Journal of Rheumatology; 12, 1985, 3, p. 458-461, 19 ref.  
Nivel (C 3606)

The researchers evaluated the effect of strenuous aerobic exercise on joint symptoms and compared the functional capacity and muscle strength among patients with rheumatoid arthritis (RA) and osteoarthritis (OA), and very sedentary matched controls. Strenuous ergometer exercise did not exacerbate joint symptoms in these patients. Isotonic leg extension and flexion as well as grip strength were diminished in the RA and OA subjects compared to controls (p less than 0.05). All subjects displayed low maximum oxygen consumption indicating reduced functional capacity. Acute bouts of strenuous exercise performed on bicycle ergometer did not appear harmful to the nonacute arthritis patient.

BIUNDO, J.J. Jr, TORRES-RAMOS, F.M.  
Rehabilitation and biomechanics.  
Current Opinion in Rheumatology; 3, 1991, 2, p. 291-299, 25 ref.  
Nivel (C 3607)

In the area of rehabilitation and biomechanics, several articles were divided into five categories, including therapeutic heat, foot and ankle orthotics, exercise in elderly arthritis patients, muscle strengt-hening in rheumatoid arthritis, and arthroplasty and immobilization are reviewed.

Rheumatoid arthritis and osteoarthritis were present in 23% of a nursing home population, but were a substantial factor for placement in only 15%. However, this group had higher pain scores, depended more on wheelchair use, and was more likely to have significant functional limitations. New data on strengthening the quadriceps in the frail elderly, whose mean age was 90.2 years, are reviewed. The relationship of quadriceps muscle strength and maximum voluntary strength as a function of age and gender and the effects of an endurance training program in 15 physically compromised nursing home residents is discussed. A static and a dynamic training program for rheumatoid arthritis patients were compared. The dynamic group significantly increased muscle strength, endurance, and aerobic capacity as compared to the static group, without any increase in disease activity. The results further showed that a home program was beneficial. Data pres-



ented show that using a Cybex isokinetic dynamometer (Lumex, Bayshore, NY) test was reliable for normal control and for rheumatoid arthritis patients who were stronger. A second attempt, however, was more representative of the weaker subjects, suggesting that initial isokinetic strength measurement in studies of rheumatoid arthritis patients may be lower than actual baseline, resulting in overestimation of strength gains. The study on the effect of continuous passive motion group was shortened by nearly 4 days compared with the average stay of the control group, and further suggested a possible protective role in the prevention of pulmonary emboli.

BUNNING, R.D., MATERSON, R.S.

A rational program of exercise for patients with osteoarthritis.

Seminars in Arthritis and Rheumatism; 21, 1991 Dec 3 Suppl 2, p.33-43

KNAW

This report provides a history of exercise therapy, defines and gives background for relevant terms, and describes common gross manifestations of osteoarthritis (OA). Bias and dogmatism concerning arthritis treatment are examined. Treatment using exercise and physical medicine modalities with reference to recent relevant literature is reviewed.

Human and animal studies demonstrating the efficacy of conditioning and strengthening in the treatment of OA are analyzed and methods to enhance compliance and directions of future exercise research are discussed.

BYERS, P.H.

Effect of exercise on morning stiffness and mobility in patients with rheumatoid arthritis.

Research in Nursing & Health; 8, 1985, 3, p. 275-281, 27 ref.

Nivel (C 3608)

The effects of evening exercises on arthrographic measures of elastic stiffness, subjective ratings of stiffness, and graphic goniometric measures of mobility were examined in 30 patients with rheumatoid arthritis. Measures were obtained on 2 consecutive mornings, one of which was randomly determined to be preceded by evening exercise. Each morning, elastic stiffness and mobility were measured before and after morning exercise. After the final measurements of elastic stiffness and mobility on the second day, patients compared stiffness on the 2 days. Elastic stiffness and subjective ratings of stiffness were less and mobility was greater when evening exercises were performed ( $p$  less than 0.001). The relationships between elastic stiffness and subjective ratings of stiffness indicated that the effect of evening exercise was perceived as greater when elastic stiffness was greater, and 21 patients

reported less stiffness with evening exercise (p less than .05).

CHAMBERLAIN, M.A., CARE, G., HARFIELD, B.

Physiotherapy in osteoarthritis of the knees.

International Rehabilitation Medicine; 4, 1982, no. 2, p. 101-106, 1 ref.

Nivel (C 3609)

Patients with osteoarthrosis of the knee were taught two simple exercises to be practised daily with graduated weights, recording the details in an instruction/record book. Patients were randomly divided into those receiving treatment at hospital, and those doing their exercises at home. Both groups showed decreased pain and increased function, maximum weight lift and endurance at the end of 4 weeks. There was no difference between the groups. Benefit was retained by most of those patients notified at 6 weeks of a further assessment session at 12 weeks; most of these subjects continued daily exercises, whereas those not notified in advance were more likely to cease exercising and experience more pain. The exercise regimens are easy to perform and document. It is suggested that if such regimens were routinely used there would be great practical benefits for patient and physiotherapist.

DANNESKIOLD-SAMSOE, B., LYNGBERG, K., RISUM, T., TELLING, M.

The effect of water exercise therapy given to patients with rheumatoid arthritis.

Scandinavian Journal of Rehabilitation Medicine; 19, 1987, 1, p. 31-35, 19 ref.

Nivel (C 3610)

It is well known that patients suffering from rheumatoid arthritis have a reduced muscular function. In this study the effect of exercise therapy performed in a heated swimming pool has been evaluated for eight patients in a non-acute stage of rheumatoid arthritis. The median pre-treatment maximal isometric and isokinetic quadriceps strength was 88 Nm (44-146) and 99 Nm (62-149) respectively, which was 61% and 70% of what was found in a control group of healthy persons.

After 2 months exercise therapy the median maximal isometric and isokinetic quadriceps strength increased by 38% and 16% compared to the pre-treatment value (p less than 0.02 and p less than 0.05). All patients, except one who developed cardiac arrhythmia during the second test, accomplished a submaximal bicycle test (a.m. Astrand). An increase in the aerobic capacity was observed in all patients after the training period.

DIAL, C., WINDSOR, R.A.

A formative evaluation of a health education - water exercise program for class II and III adult rheumatoid arthritis patients.

Patient Education and Counseling; 7, 1985, no. 1, p. 33-42

Nivel (C 3611)

There is little scientific evidence to support the use of water-related rehabilitation programs for individuals with arthritis. This study was designed to conduct a preliminary assessment of the short term impact of an 8-week, health education - water exercise program for 12 adults with rheumatoid arthritis. A one group pretest-posttest with repeated measures design was employed. Patient evaluation techniques included standard goniometric measurement of active range of motion of major joints, grip strength, timed functional tasks and a self-report questionnaire. All participants were evaluated on four separate occasions. The results of the evaluations revealed that, subjectively, all participants expressed physical and psychological improvement. Significant improvement for 8 of 12 selected physical impact variables was observed at the end of the program and for at least 4 weeks postprogram. A sufficient degree of impact was noted to recommend proposing a larger, more rigorous study.

EICHNER, E.R.

Exercise and arthritis. The hematology of inactivity.

Rheumatic Disease Clinics of North America; 16, 1990, 4, p. 815-825, 49 ref.

Nivel (C 3612)

Arthritis tends to promote inactivity, and inactivity tends to promote an unhealthy constellation of blood abnormalities which increases the risk of heart attack and stroke. The hematology of inactivity comprises the following: low plasma volume, high haematocrit, high plasma fibrinogen, elevated blood viscosity, increased platelet aggregability, and diminished fibrinolysis.

Regular exercise reverses all these adverse blood changes and, thereby, helps prevent heart attack and stroke. Exercise "improves" the blood, making it flow more easily and clot less readily. This "healthy hematology of exercisers" is one more reason why prudent exercise is as vital for patients with arthritis as it is for the rest of the people.

EKBLOM, B., LOVGREN, O., ALDERIN, M., FRIDSTROM, M.,

SATTERSTROM, G.

Effect of short-term physical training on patients with rheumatoid arthritis I.

Scandinavian Journal of Rheumatology; 4, 1975, p. 80-86, 7 ref.

Nivel (C 3613)

Thirty-four patients with rheumatoid arthritis, aged 38 to 63 years (mean age 56 years), were studied before and after a 6-week stay

in hospital. Twenty-three of these patients underwent special physical training twice a day during this period. Physical performance, cardio-respiratory fitness and muscle strength improved significantly in the training group. In the control group there were no major changes in these measurements during this period except for an increase in muscle strength. Perceived exertion during submaximal exercise was much lower in the training group following the conditioning. Joint status was virtually unchanged over the experimental period in both groups. It is postulated that the low physical performance seen in these types of RA patients may, to large extend, be attributed to lack of physical activity.

EKBLOM, B., LOVGREN, O., ALDERIN, M., FRIDSTROM, M.,  
SATTERSTROM, G.

Effect of short-term physical training on patients with rheumatoid arthritis: a six month follow-up study.

Scandinavian Journal of Rheumatology; 4, 1975, p. 87-91, 3 ref.

Nivel (C 3614)

Twenty-three patients with rheumatoid arthritis were retested about 6 months after 5 weeks of physical conditioning and 7 patients from a former control group patients, who had continued to train about 4 times or more per week, had maintained the improved physical status obtained during the initial conditioning, while those patients who had trained less than that or discontinued training, had lost some or most of their improvement. The physical status in the former control group was virtually remained unchanged. Joint status in the former training group was no different at re-test than at post-training or pre-training examinations.

EKDAHL, C.

Muscle function in rheumatoid arthritis. Assessment and training.

Scandinavian Journal of Rheumatology; 86, 1990, Suppl., p. 9-61, 147 ref.

Nivel (C 3615)

The conclusions can be summarized as follows: experienced problems of muscle function were reported in about 80% of RA and OA patients for whom there was involvement of large joints of the lower extremities. RA and OA patients did not differ as to experienced problems of muscle strength, endurance and balance/coordination. Problems of muscle function were correlated with functional tests of muscle strength but not with those of endurance and balance/coordination. Problems of muscle strength were found to correlate with LE-ADL, whereas problems of endurance and balance/coordination were not found to correlate with the latter. The translated and slightly modified version of the HAQ questionnaire appeared to possess a high degree of reliability and validity in assessing disability in patients with RA under Swedish

conditions. A quantitative battery of tests for the evaluation of standing balance on a computerized force platform was found to be satisfactorily reliable and to correlate in healthy subjects with most of the functional tests employed. In healthy subjects, standing balance appeared to be related not only to age but also to sex, males and older age groups showing greater postural sway than females and persons of younger age groups. Compared with healthy subjects, RA subjects showed significantly greater postural sway, differences being greatest for those tests representing a relatively high level of difficulty. Dynamic training for six weeks appeared to provide RA patients with a greater increase in physical capacity of the lower extremities than did static training, the gains thus obtained still being present after an additional three-month period. The effectiveness of the dynamic training programs did not vary with the degree of supervision of training by a physiotherapist, i.e. of 12 visits or 4 being made at the health care centre; despite the intensity of the dynamic training program employed with RA patients, no increase in pain experience or disease activity was found during the training-period. During short-term high-intensity training a significant increase in circulating beta-EP was found between the 3rd and 6th weeks of training, no increase in CRF and beta-LPH being present. Following a long-term low-intensity training period, a significant increase of CRF and beta-LPH was found, no similar increase being noted for beta-EP.

EKDAHL, C., ANDERSON, S.I., MORITZ, U., SVENSSON, B.  
Dynamic versus static training in patients with rheumatoid arthritis.  
Scandinavian Journal of Rheumatology; 19, 1990, 1, p. 17-26, 30 ref.  
Nivel (C 3616)

Sixty-seven patients with classical or definite rheumatoid arthritis (RA) were studied concerning the effects of standardized physical training on muscle function in the lower extremities. The patients were randomly assigned to four different training groups and were given 6 weeks of training supervised by a physiotherapist at a health care centre. The groups differed according to type (dynamic or static) and extent (12 or 4 times) of training. During this training period as well as for an additional 3 months period, the patients carried out programs of exercise at home (either dynamic or static). A significantly greater increase in function during the 6-week period as regards muscle strength, endurance, aerobic capacity, and functional ability was found for the dynamic group as compared with the static groups. The findings at the follow-up study 3 months later were similar. The effectiveness of the programs did not vary with the extent of the training. In conclusion, in RA patients, dynamic training seems to give a greater increase in physical capacity than does static training.

ERNST, E.

Physikalische Therapie der rheumatoiden Arthritis.

Fortschritte der Medizin; 108, 1990, 7, p. 117-20, 12 ref.

Nivel (C 3617)

Physiotherapy is an important component of the treatment regimen for rheumatoid arthritis, and is aimed mainly at reducing pain and preserving function. Depending on the severity of the disease and the clinical picture, physiotherapy, ergotherapy, hydrotherapy and heat treatment, as well as massage and electrotherapy may all be considered. When properly applied, these treatments have the advantage of being free of side effects. Scientific proof of effectiveness is often lacking in physical medicine, which clearly represents a challenge to the discipline in the years to come.

FISHER, N.M., PENDERGAST, D.R., GRESHAM, G.E., CALKINS, E.

Muscle rehabilitation: its effect on muscular and functional performance of patients with knee osteoarthritis.

Archives of Physical Medicine and Rehabilitation; 72, 1991, 6, p. 367-374, 28 ref.

Nivel (C 3618)

Muscle function and functional performance are limited in patients with osteoarthritis (OA). Although aerobic exercise can increase aerobic power and reduce fatigue, it does not appear to improve muscle function. The purpose of this study was to demonstrate the effect of a muscle rehabilitation program on muscle strength, endurance, speed, and function for patients with OA of the knees. Fifteen men (67.6 +/- 6.1 years) with OA of the knees underwent a four-month exercise program, three times per week.

Muscle strength, endurance, and speed were 50% less in OA patients than in controls. After rehabilitation, there was a significant increase in strength (35%), endurance (35%), and speed (50%). Deficiencies and improvements in the muscles were greater at longer muscle lengths. Increases in muscle function were associated with decreased dependency (10%), difficulty (30%), and pain (40%). The average increase in all measured parameters was 10% and 25% after two and four months of rehabilitation, respectively. Improvements were sustained for eight months after rehabilitation. The muscle rehabilitation program was designed specifically to improve function; the improved muscle function was translated into improved functional performance.

GERBER, L.H.

Exercise and arthritis.

Bulletin on the Rheumatic Diseases; 39, 1990, 6, p. 1-9, 66 ref.

Nivel (C 3619)

The physician caring for patients with arthritic conditions is often interested in supplementing pharmacological treatment with other therapy to maintain and facilitate purposeful movement. This review describes the various forms of exercise and their therapeutic applications to persons with rheumatoid diseases.

HARKCOM, T.M., LAMPMAN, R.M., BANWELL, B.F., CASTOR, C.W.  
Therapeutic value of graded aerobic exercise training in rheumatoid arthritis.  
Arthritis and Rheumatism; 28, 1985, 1, p. 32-39, 25 ref.  
Nivel (C 3620)

Women with rheumatoid arthritis performed 1 of 3 low intensity aerobic exercise protocols (15, 25, and 35 minutes) 3 times per week for 12 weeks. A nontraining group served as controls. All exercise groups improved their aerobic capacity, exercise time, and joint counts. Subjects described improvement in activities of daily living and reduced joint pain and fatigue. Exercise duration up to 35 minutes can be therapeutic, and as little as 15 minutes of exercise 3 times a week is sufficient to improve aerobic capacity in rheumatoid arthritis patients with severe limitations.

HAWKES, J., CARE, G., DIXON, J.S., BIRD, H.A., WRIGHT, V.  
Comparison of three physiotherapy regimens for hands with rheumatoid arthritis.  
British Medical Journal; 291, 1985, no. 6501, p. 1016  
Nivel (C 3621)

Thirty inpatients with classical or definite rheumatoid arthritis affecting the hands were recruited. All with pain and swelling of the hands and limitations of movement. Patients remained in hospital throughout a three week study period.

The patients were allocated at random to three groups. Group I received wax treatment followed by standard exercises for five days a week. The wax procedure entailed dipping the hands into melted wax 10 times, then wrapping them in greaseproof paper with a blanket which was left on for 20 minutes. Group II received ultrasound followed by standard exercises. Group III received ultrasound and faradic hand baths followed by standard exercises.

HICKS, J.E.  
Exercise in patients with inflammatory arthritis and connective tissue disease.  
Rheumatic Disease Clinics of North America; 16, 1990, 4, p. 845-870  
Nivel (C 3622)

Patients with systemic rheumatic diseases suffer from significant loss of biomechanical integrity of joints as a result of joint structural

and soft-tissue changes. These deficits cause limited joint motion and muscle-strength deficits. The overall aerobic capacity is also reduced. Exercise programs have been shown to increase joint motion, muscle strength, and endurance and should be initiated early in the course of the disease.

IKE, R.W., LAMPMAN, R.M., CASTOR, C.W.

Arthritis and aerobic exercise: a review.

The physician and sportsmedicine; 17, 1989, no. 2, p. 128-138, 25 ref.

Nivel (C 3623)

Despite increasing evidence that regular aerobic exercise yields many benefits for patients with arthritis, these patients are often advised to curtail physical activity. Findings from studies of patients with either rheumatoid arthritis or osteoarthritis who participated in an aerobic exercise program show that the subjects made significant gains in aerobic capacity, functional status, muscle strength, and other aspects of performance. In addition, they improved in subjective aspects that might have a positive impact on the quality of life, including pain tolerance, joint pain, mood, and social activity. The authors discuss some questions that remain unanswered and present guidelines for physicians who wish to prescribe aerobic exercise for their patients,

JOKL, P.

Prevention of disuse muscle atrophy in chronic arthritides.

Rheumatic Disease Clinics in North America; 16, 1990, 4, p. 837-844

Nivel (C 3624)

This article briefly reviews the causes and physiological considerations of skeletal muscle disuse atrophy. This is a common problem associated with chronic arthritides. Methods of preventing or modifying this disability are presented.

KARPER, W.B., EVANS, B.W.

Cycling program effects on one rheumatoid arthritic.

The American Journal of Physical Medicine; 65, 1986, 4, p. 167-172, 13 ref.

Nivel (C 3625)

The researchers investigated the effects of a progressive resistive, cycle ergometric exercise program on cardio-vascular endurance in one rheumatoid arthritic. The 46 year old male subject exercised three days a week for 14 weeks. Workouts included interval-type training using 5 minute intervals for a total of 20-30 minutes (with a work rate set at 50-75 watts for each interval), not including 3-minute warm-up and cool-down periods (work rate set at zero resistance). Maximal exercise stress testing on the cycle ergometer was



completed and blood samples were collected before and after the exercise program. Also, psychological and physical health and lifestyle data were gathered before, during and after completion of the program. The conditioning program produced a training effect (greater than 75% of the HR max after the second exercise session) and an improvement of blood values (10-28%) from the beginning to the end of the program. Finally, the program appeared to have a positive influence on various physical and psychological parameters as perceived by the subject and his wife.

KIRSTEINS, A.E., DIETZ, F., HWANG, S.M.  
Evaluating the safety and potential use of a weight-bearing exercise, Tai-Chi Chuan, for rheumatoid arthritis patients.  
American Journal of Physical Medicine & Rehabilitation; 70, 1991, 3,  
p. 136-141, 16 ref.  
Nivel (C 3626)

The safety of a traditional Chinese exercise, Tai-Chi Chuan, on rheumatoid arthritis (RA) patients was evaluated. RA patients, who received 1 hour of Tai-Chi Chuan instruction once (n = 20) and twice (n = 15) a week for 10 consecutive weeks in two separate studies, showed no deterioration in their clinical disease activities compared with the corresponding controls (n = 11 and 9, respectively). Testing parameters included joint tenderness, joint swelling, time to walk 50 feet, handgrip strength and a written functional assessment. No significant exacerbation of joint symptoms using this weight-bearing form of exercise was observed. Tai-Chi Chuan exercise appears to be safe for RA patients and may serve as an alternative for their exercise therapy and part of their rehabilitation program. Weight-bearing exercises seem to have the potential advantages of stimulating bone growth and strengthening connective tissue, but this effect needs to be documented in long-term studies.

KOTKKE, T.E., CASPERSEN, C.J., HILL, C.S.  
Exercise in the management and rehabilitation of selected chronic diseases.  
Preventive Medicine; 13, 1984, p. 47-65, 76 ref.  
Nivel (C 3627)

The effects of exercise on the progression of eight chronic diseases or medical conditions are reviewed. What concerns rheumatoid arthritis, the authors conclude that exercise has no therapeutic role in acute exacerbations of RA, but may be beneficial in the chronic stages.

KREINDLER, P.T., LEWIS, C.B., RUSH, S., SCHAEFER, P.T.

Effects of three exercise protocols on strength of persons with osteoarthritis of the knee.

Topics in Geriatric Rehabilitation; 4, 1989, no. 3, p. 32-39

Nivel (C 3628)

This article investigates the effect of different types of exercise on strength of the hamstring and quadriceps muscles in elderly patients with a primary diagnosis of osteoarthritis of the knee. The article is based on a study designed to evaluate and quantify changes from exercise done traditionally and isokinetically, to determine which exercise, or combination of exercises, has the most significant effect on increasing strength.

LEIVSETH, G., TORSTENSSON, J., REIKERAS, O.

Effect of passive muscle stretching in osteoarthritis of the hip.

Clinical Science; 76, 1989, 1, p. 113-117, 25 ref.

Nivel (C 3629)

Twenty-five minute daily muscle stretching, perpendicular to the fibre direction of the adductor muscles without movement of the hip, was performed by patients with osteoarthritis of the hip. Before and after treatment hip abduction was measured and muscle biopsies were taken for analysis of fibre cross-sectional areas of type 1 and type 2 fibres as well as adenosine 5'-triphosphate, creatine phosphate and glycogen contents. From the results it is concluded that passive muscle stretching leads to a significant increase in hip abduction of 8.3 degrees ( $p$  less than 0.05). There was also a significant increase of type 1 and type 2 fibre cross-sectional area and of glycogen content after the treatment period ( $p$  less than 0.05), but the concentrations of adenosine 5'-triphosphate and creatine phosphate did not change significantly.

LYNGBERG, K., DANNESKIOLD-SAMSOE, B., HALSKOV, O.

The effect of physical training on patients with rheumatoid arthritis: changes in disease activity, muscle strength and aerobic capacity. A clinically controlled minimized cross-over study.

Clinical and Experimental Rheumatology; 6, 1988, 3, p. 253-260, 31 ref.

Nivel (C 3630)

For decades, physical training of rheumatoid arthritis (RA)-patients has been controversial, especially for patients with active disease. The aim of this study was to investigate whether RA-patients could receive graduated training without increasing the activity of the disease. In a controlled cross-over study the effect of graduated progressive training has been evaluated in 18 RA-patients with moderately active disease. The training was performed twice weekly with aerobic conditioning and strength exercises progressing to

strenuous exercises over an 8-week period. The design was a crossover project with two groups obtained by minimisation. After training the patients had significantly fewer swollen joints than before. Training of the muscles acting over the swollen joints resulted in more than a 35% decrease in the number of swollen joints. The hemoglobin level increased significantly after the training period. The erythrocyte sedimentation rate, the complement factor C<sub>3</sub>d, and the number of sore joints remained unchanged. A decrease in the need for medicine was non-significant. From this study it seems to appear that RA-patients with some activity are trainable without aggravating the disease, even in the chronically swollen joints. The rheumatoid arthritis activity decreased with fewer swollen joints and higher hemoglobin level after training.

MACHOVER, S., SAPECKY, A.J.

Effect of isometric exercise on the quadriceps muscle in patients with rheumatoid arthritis.

Archives of Physical Medicine & Rehabilitation; 1966, nov., p. 737-741

Nivel (C 3631)

The effect of maximum isometric contractions of the quadriceps apparatus carried out three times daily except saturday and sunday was followed for seven weeks in 11 middle-aged patients having rheumatoid arthritis. In the majority of subjects, the weaker quadriceps muscle was employed as the test side with the contalateral side as control. Improvements in strength of the exercised quadriceps occurred in the majority of the subjects with an overall average gain in strength of 23.3 per cent. The control side showed a cross-over effect and possible explanations for this are discussed. The conclusion reached is that an isometric exercise program can increase strength of the quadriceps muscle in the rheumatic arthritic patient and should be incorporated in the standard exercise program.

MCCUBBIN, J.A.

Resistance exercise training for persons with arthritis.

Rheumatic Disease Clinics of North America; 16, 1990, 4, p. 931-943, 30 ref.

Nivel (C 3632)

This article reviews the benefits of resistance exercise training in the rehabilitation of persons with arthritis. Without question, the person with arthritis has a need to develop muscular strength and endurance in order to maintain functional movement. Deficits in muscular strength, muscular endurance, range of motion, and other physical fitness indices have been identified clearly in the literature. Research studies have indicated that the effect of training persons with arthritis is promising. However, deficits exist in the literature on the types of specific exercise protocol that are most effective in

training persons with arthritis. Guidelines for program development are provided with suggestions for alternative types of resistance exercise programs.

MCNEAL, R.L.

Aquatic therapy for patients with rheumatic disease.

Rheumatic Disease Clinics of North America; 16, 1990, 4, p.915-929, 22 ref.  
Nivel (C 3633)

Aquatic therapy is a rapidly expanding, beneficial form of patient treatment. Understanding the theory of water techniques is essential in implementing an aquatic therapy program. The success of the program, however, will always depend on the pleasure and benefits achieved by the patients because rheumatic patients most likely will need to modify their previous daily functioning. So patients need to be aware of the long-term ramifications of the disease process and understand how treatment and care may be altered during various stages of exacerbation and remission. Patient education is critical in ensuring individual responsibility for the changes that must be made when not supervised by a professional.

Aquatic therapy is a step in moulding a positive lifestyle change for the patient. The patient can be encouraged to be fitness oriented and, at the same time, exercise in a manner that is safe, effective, and biomechanically and physiologically sound. The environment also will be conducive to family and social interaction that ultimately encourages the compliance of long-term exercise programs.

MILLION, R.

Long term study of management of rheumatoid arthritis.

Lancet; 1, 1984, p. 812

KNAW

MINOR, M.A., HEWETT, J.E., WEBEL, R., ANDERSON, S.K., KAY, D.R.

Efficacy of physical conditioning exercise in patients with rheumatoid arthritis and osteoarthritis.

Arthritis and Rheumatism; 32, 1989, 11, p. 1396-1405, 33 ref.

Nivel (C 3634)

A group of 120 patients with rheumatoid arthritis or osteoarthritis volunteered to be subjects for this study of aerobic versus nonaerobic exercise. Patients were stratified by diagnosis and randomized into an exercise program of aerobic walking, aerobic aquatics, or nonaerobic range of motion (controls). The retention rate for the 12-week program was 83%. Exercise tolerance, disease-related measures, and self-reported health status were assessed.

The aquatics and walking exercise groups showed significant improvement over the control group in aerobic capacity, 50-foot

walking time, depression, anxiety, and physical activity after the 12-week exercise program. There were no significant between-grow-up differences in the change scores for flexibility, number of clinically active joints, duration of morning stiffness, or grip strength.

MINOR, M.A., HEWETT, J.E., WEBEL, R.R., DREISINGER, T.E., KAY, D.R.  
Exercise tolerance and disease related measures in patients with rheumatoid arthritis and osteoarthritis.  
The journal of rheumatology; 15, 1988, p. 905-911, 40 ref.  
Nivel (C 3635)

One hundred and twenty patients with rheumatoid arthritis (RA) or osteoarthritis (OA) in weight bearing joints (RA=40, OA=80) performed subjective maximally graded exercise tests on a motor driven treadmill. Disease related measures were also assessed. Findings from this sample indicated that people with arthritis were significantly impaired in exercise tolerance, flexibility and biomechanical efficiency. Significant differences between diagnoses appeared on a number of disease related measures. However, there was little correlation between disease related measures and exercise tolerance. Women demonstrated a greater aerobic impairment than men, women with RA had a greater aerobic deficit than women with OA.

MONCUR, C., WILLIAMS, H.J.  
Cervical spine management in patients with rheumatoid arthritis. Review of the literature.  
Physical Therapy; 68, 1988, 4, p. 509-515, 60 ref.  
Nivel (C 3636)

Rheumatoid arthritis of the cervical spine is a well-recognized source of neck pain. However there has been discussion about the potential effects of various treatment interventions on the tissues of patients with rheumatoid arthritis of the cervical spine in the physical therapy literature. Physical therapists should understand the implications of this type of inflammatory arthritis when treating patients with rheumatoid arthritis. The end-stage results of the inflammatory process and the mechanical forces on the cervical spine can cause atlantoaxial subluxation, atlantoaxial impaction, and subaxial subluxation. The purpose of this article is to review the literature on several aspects of rheumatoid arthritis of the cervical spine, that is the pathological anatomy, clinical findings, surgical management, management with cervical orthoses, and physical therapy management.

NAMEY, T.C.

Exercise and arthritis. Adaptive bicycling.

Rheumatic Disease Clinics of North America; 16, 1990, 4, p. 871-886, 34 ref.

Nivel (C 3637)

This article outlines the physical and biomechanical advantages of bicycling as exercise for rheumatoid patients and gives types of equipment available for both outdoor and indoor use. The proper mechanics of efficient bicycling and appropriate fit of machine to rider are addressed. Finally, guidelines are offered to initiate both indoor and outdoor cycling programs.

NORDEMAR, R., BERG, U., EKBLÖM, B., EDSTROM, L.

Changes in muscle fibre size and physical performance in patients with rheumatoid arthritis after 7 months physical training.

Scandinavian Journal of Rheumatology; 5, 1976, p. 70-76, 26 ref.

Nivel (C 3638)

Ten patients with rheumatoid arthritis of moderate severity were given 6 weeks of intense physical training. During the investigation period the patients improved their physical performance capacity as well as their rate of perceived exertion. There was an increase in the muscle fibre size, of type I and type II, most pronounced in the latter fibre group. No 'flare-up' of the arthritis could be seen during the training period. Comments are made as to which patients might benefit by a short-term physical training.

NORDEMAR, R., BERG, U., EKBLÖM, B., EDSTROM, L.

Changes in muscle fibre size and physical performance in patients with rheumatoid arthritis after 7 months physical training.

Scandinavian Journal of Rheumatology; 5, 1976, p. 233-238, 23 ref.

Nivel (C 3639)

Ten patients with rheumatoid arthritis of moderate severity were given 7 months physical training. During the investigation period the patients improved their physical performance capacity and at the same time lowered their rate of perceived exertion during submaximum exercise. There was small increase in muscle fibre size and a correlation was found between muscle strength and type II fibre size. Clinical examination and X-ray studies did not reveal any further joint destruction during the investigation period

NORDEMAR, R., EKBLÖM, B., ZACHRISSON, L., LUNDQVIST, K.

Physical training in rheumatoid arthritis: a controlled long term study I.

Scandinavian Journal of Rheumatology; 10, 1981, p. 17-23, 27 ref.

Nivel (C 3640)

Twenty-three patients with rheumatoid arthritis (RA) have been given physical training for 4 to 8 years. To compare, a control group of equal size and with the same disease severity was available. The training program consisted of home-training and for most of the patients also of group-training led by a physiotherapist. During the observation period a significantly less pronounced progress of X-ray changes in the joints of the active patients compared with control patients was found. Physiological tests and clinical parameters, including sick-pension and sick-leave, showed a better disease outcome in the active group of patients. There is probably a risk of overuse or disuse of the joints in RA but as in many other diseases, the general description of rest in RA is not adequate.

NORDEMAR, R., EKBLUM, B., ZACHRISSON, L., LUNDQVIST, K.  
Physical training in rheumatoid arthritis: a controlled long term study II.  
Functional capacity and general attitudes.  
Scandinavian Journal of Rheumatology; 10, 1981, p. 25-30, 12 ref.  
Nivel (C 3641)

Twenty-three patients with rheumatoid arthritis (RA) have been given physical training for 4 to 8 years. To compare, a control group of equal size and with the same disease severity was available. In order to evaluate disease outcome, patients were given a self-administered questionnaire to report ADL capacity and some attitudes and feelings concerning their situation. Results are in agreement with earlier reports and show a higher ADL capacity in the trained group compared with the control group. There is a positive correlation between ADL capacity and the reported amount of physical training and a negative correlation between ADL capacity and X-ray findings and findings at clinical examination.

PANUSH, R.S.  
Exercise and Arthritis.  
Topics in Geriatric Rehabilitation; 4, 1989, no. 3, p. 23-31  
Nivel (C 3642)

Osteoarthritis is the most common type of arthritis. There have been several recent developments relating to osteoarthritis in recent years. This review highlight these with special emphasis on the possible role of exercise in causing or managing osteoarthritis.

PERLMAN, S.G., CONNELL, K.J., CLARK, A., ROBINSON, M.S., CONLON, P.,  
GECHT, M., CALDRON, P., SINACORE, J.M.  
Dance-based aerobic exercise for rheumatoid arthritis.  
Arthritis Care and Research; 3, 1990, 1, p. 29-35, 21 ref.  
Nivel (C 3643)

Reported here are the results of an effort to examine the effects of a dance-based aerobic exercise program for people with rheumatoid arthritis (RA). Forty-three subjects with RA completed a 16 week program that met twice weekly for 2 hours. One hour was devoted to exercise consisting of 15 to 20 minutes of warm-ups, 20 to 30 minutes of dance-based aerobic exercise, and 15 to 20 minutes of mat work for muscle strengthening and flexibility. The second hour was devoted to a discussion which emphasized participant problem solving. The combined exercise/problem-solving discussion program was called 'educize'. Analyses of pretest to posttest changes indicated no deleterious effects on disease activity. In fact, physician-assessed articular pain and swelling decreased significantly, as did 50-foot walk time, pain, and depression. Participants reported significant improvement in lower extremity function. Changes in vigor and fatigue approached significance. Perceptions of general health as well as four of five quality of life indices improved significantly. This study adds to the as yet limited literature that indicates that weight-bearing vigorous exercise is beneficial for people with arthritis. Controlled studies to validate the findings of this study appear warranted. Also important for future research is investigation of the influence of the problem-solving discussion component on program effects.

POTHIER, B., ALLEN, M.E.

Exercise and arthritis. *Kinesiology and the degenerative joint.*

*Rheumatic Disease Clinics of North America*; 16, 1990, 4, p. 989-1002, 22 ref.  
Nivel (C 3644)

Advanced methods of testing allows the kinesiologist to demonstrate qualities and quantities of muscular and joint performance heretofore not available. These discerning tests shed a new light on problems related to arthritis, the dilemmas of disuse atrophy, and the benefits of exercise rehabilitation. Principles of exercise for the degenerative joint are offered.

RUDD, E.

Physiatric management of osteoarthritis.

*Clinics in Rheumatic Diseases*; 11, 1985, 2, p. 433-45, 24 ref.  
Nivel (C 3645)

In this article it is considered how a practitioner can use physical measures to control pain, restore and maintain joint function in osteoarthritis. According to the author, the overall aim should be to prevent joint impairment from becoming a disability and a handicap. This should be done by means of a combination of rest, exercise and the use of heat and cold.

Services to patients with chronic diseases as rheumatoid arthritis should be community based. Therefore, a change of the negative



attitude of patients, their families, and society in general is of prime concern.

SCHMIDT, K.L.

Physikalische Therapie und Balneotherapie der Arthrosen.

Therapeutische Umschau; 48, 1991, 1, p. 46-51, 8 ref.

Nivel (C 3646)

The 'points of attack' of physical therapy in osteoarthritis are the impaired metabolism of cartilage, the accompanying extra-articular pains in ligaments and muscles and the secondary inflammation. Heat treatment and exercises both have useful metabolic effects. Furthermore, they influence pain, muscle tone, mobility and blood flow. When secondary inflammation occurs, osteoarthritis should be treated like joint inflammations with short time immobilisation and cold treatment.

Osteoarthritis of small finger joints can be treated in the same manner as osteoarthritis of large joints by movement-exercises in warm or cold mud. Spa-treatment as a combination of warm springs, mud etc, with exercises, dietary supplement and health education is a very traditional and useful kind of treatment of osteoarthritis with long term effects. Measurements of physical therapy are also of preventive value. Since physical therapy is always strenuous for the organism, in higher age it must be used carefully and well adapted to the tolerability of patients.

SEMBLE, E.L., LOESER, R.F., WISE, C.M.

Therapeutic exercise for rheumatoid arthritis and osteoarthritis.

Seminars in Arthritis and Rheumatism; 20, 1990, 1, p. 32-40, 48 ref.

Nivel (C 3647)

Therapeutic exercise in rheumatoid arthritis and osteoarthritis may be useful in improving aerobic capacity, strengthening muscles, improving endurance and increasing flexibility. This article reviews the major studies of exercise in these conditions and summarizes the authors' recommendations regarding the use of therapeutic exercise in the treatment of rheumatoid arthritis osteoarthritis.

SPRING, H.

Sport bei Spondylitis ankylosans.

Schweizerische Rundschau für Medizin Praxis; 80, 1991, no.23, p. 629-635

KNAW

Because therapy of ankylosing spondylarthritis still remains empirical, gymnastics and sports are of particular importance within the treatment of this disease. They aim to improve or at least to preserve mobility, force and endurance. By those means, an

eventual immobilisation of the axial skeleton or the peripheral joints should take place in a position as favourable to function as possible. Various joint mobilisation techniques as well as muscle stretching are used to improve mobility. The latter prevents muscular disbalances.

Various training methods are able to improve muscular performance. Slow dynamic force training can be used in gymnastic lessons as well as in home programmes. Maximal and staying power can thus be increased. Aerobic muscular training favours general efficiency, has a positive influence on risk factors of cardiac and vascular diseases and improves thoracic excursion. The motivation of the patient is correlated with the diversion of exercise, therapies and sporting activities. The suitability of these measures are to be judged by expected maximal strain, the control of motion pattern, the effect of external forces as well as by the hazard to fall. Each and every sporting activity has to be accompanied by supportive gymnastics. The most important sporting disciplines are evaluated.

STENSTROM, C.H., LINDELL, B., SWANBERG, E., HARMS-RINGDAHL, K., NORDEMAR, R.

Functional and psychosocial consequences of disease and experience of pain and exertion in a group of rheumatic patients considered for active training. Result of a survey in Bollnas Medical District. I.

Scandinavian Journal of Rheumatology; 1990 19(5): 374-382, 36 ref.  
Nivel (C 3648)

The purpose of this study was to select and describe a group of patients with rheumatoid arthritis (RA) within a defined area who had, on clinical grounds, been considered for active training. The group consisted of 69 patients with classical or definite RA and comprised half of the RA patients known to the clinic. The patients were assessed by means of a questionnaire, functional tests with rating of activity-induced pain, a cycling-test with rating of perceived exertion, and an interview by a psychologist.

Subjective disease consequences were pain and stiffness. 38% of the patients never or seldom did any exercises at all. 72% wished to increase their activity but were prevented by pain. The functional tests indicated slow performance and considerable pain in activities of daily life. What the interview disclosed above all, was a low degree of self-confidence. Generalized pain and functional impairment correlated slightly with psychosocial factors. The results of the study indicate the need for active training as one strategy to alleviate pain and to maintain functional capacity in RA patients.

SUWALSKA, M.

Importance of physical training of rheumatoid patients. (with comment of B. Ekblom)

Annals of Clinical Research; 14, 1982, suppl. 34, p. 107-109, 5 ref.

Nivel (C 3649)

Rheumatoid arthritis is a systemic disease which affects joint synovials. The inflammatory process begins in the synovial membranes. Going progressively it destroys cartilage and bone and leads to destruction of all parts of joints bringing severe deformities. The proper physical exercises for rheumatic patients are intended to limit the reflectory muscle tension, to enlarge the range of motion, to strengthen muscle force and to improve physical fitness. Physical exercises should not damage the rheumatoid joints but they should be performed with the limitation of joint surface loading.

TORK, S.C., DOUGLA S.V.

Arthritis water exercise program evaluation. A self-assessment survey.

Arthritis Care and Research; 2, 1989, 1, p. 28-30, 2 ref.

Nivel (C 3650)

The buoyancy of water and the ability to control its temperature make it ideal for patients with muscular and joint disease. Exercise combined with the physical properties of water, provides a setting for people with rheumatic diseases to increase range of motion, strength and function.

The purpose of this article is an initial attempt to address the need for evaluation of aqua-exercise programs. The authors report the results of a survey designed to evaluate the effectiveness of one aqua-exercise class, the aquatic program of the Kansas Chapter of the Arthritis Foundation.

TOUZET, P., MARCHOT, O.

Place de la kinesitherapie dans le traitement des arthrites chroniques juveniles.

Pediatrie; 46, 1991, 2, p. 161-171

Nivel (C 3651)

Physiotherapy is of major interest in the management of juvenile chronic arthritis. Either in specialized care units or at home, during acute inflammatory phases, relapses, or after surgery, it prevents bad postures, maintains articular mobility of affected or unaffected joints, and thus protects the functioning potential of all articulations. Although physiotherapy is a long-term and often difficult procedure, it is essential in order to provide an acceptable life for affected children.

VAN DEUSEN J., HARLOWE, D.

The efficacy of the ROM Dance Program for adults with rheumatoid arthritis. *The American Journal of Occupational Therapy*; 41, 1987, 2, p. 90-95, 24 ref. Nivel (C 3652)

This study examined the efficacy of an exercise and relaxation program for adults with rheumatoid arthritis. The program integrates principles of occupational therapy and T'ai-Chi Ch'uan and was expected to be more effective than traditional exercise and rest regimens because of its supposed expressive and pleasurable elements. There were significant differences between 17 experimental and 16 control subjects on two categories of dependent variables after the former group's participation in the experimental program. These dependent variables were range of motion measures and subject self-reports of frequency, enjoyment, and benefits of home exercise and rest routines.

Pretest, posttest, and 4-month follow-up data were analyzed. Program participants showed significantly greater upper extremity range of motion 4 months after completing the program although the reported frequency of exercise and rest was greater in the control group. Postprogram reports of enjoyment were significantly higher for experimental than for control subjects.

VERBRUGGE, L.M., GATES, D.M., IKE, R.W.

Risk factors for disability among U.S. adults with arthritis. *Journal of Clinical Epidemiology*; 44, 1991, 2, p. 167-182, 81 ref. Nivel (C 3653)

This article studies risk factors for physical and social disability among U.S. adults (ages 55+) who have arthritis, compared to non-arthritis persons of the same age. The dependent variables refer to difficulties in walking, physical functioning (motions and strength), personal care, and household care. The data set is the Supplement on Aging (SOA) (n = 16,148) that accompanied the 1984 National Health Interview Survey. The SOA data are cross-sectional. Relationships of risk factors to disability suggest causation but do not directly demonstrate it. Logistic regressions show that risk factors are similar for arthritis and non-arthritis people, with one important exception. (1) The similarities are: For both groups, odds of disability rise with age, diminish with education, and are higher for non-whites and non-married persons. Disability rises with number of chronic diseases and impairments, and it is elevated for underweight persons (Body Mass Index (BMI) less than 20; further analysis indicates this reflects incomplete control of their severe illness status). Long duration of arthritis and recent medical care for it are associated with disability. (2) The exception is: Severe overweight (BMI greater than or equal to 30) is a disability risk factor for arthritis people, but not for non-arthritis people. Previous research has shown that obesity/overweight is a risk factor for

etiology of osteoarthritis; our analysis now shows its continued importance for disability when the disease is present.

WRIGHT, V., HOPKINS, R., JACKSON, M.

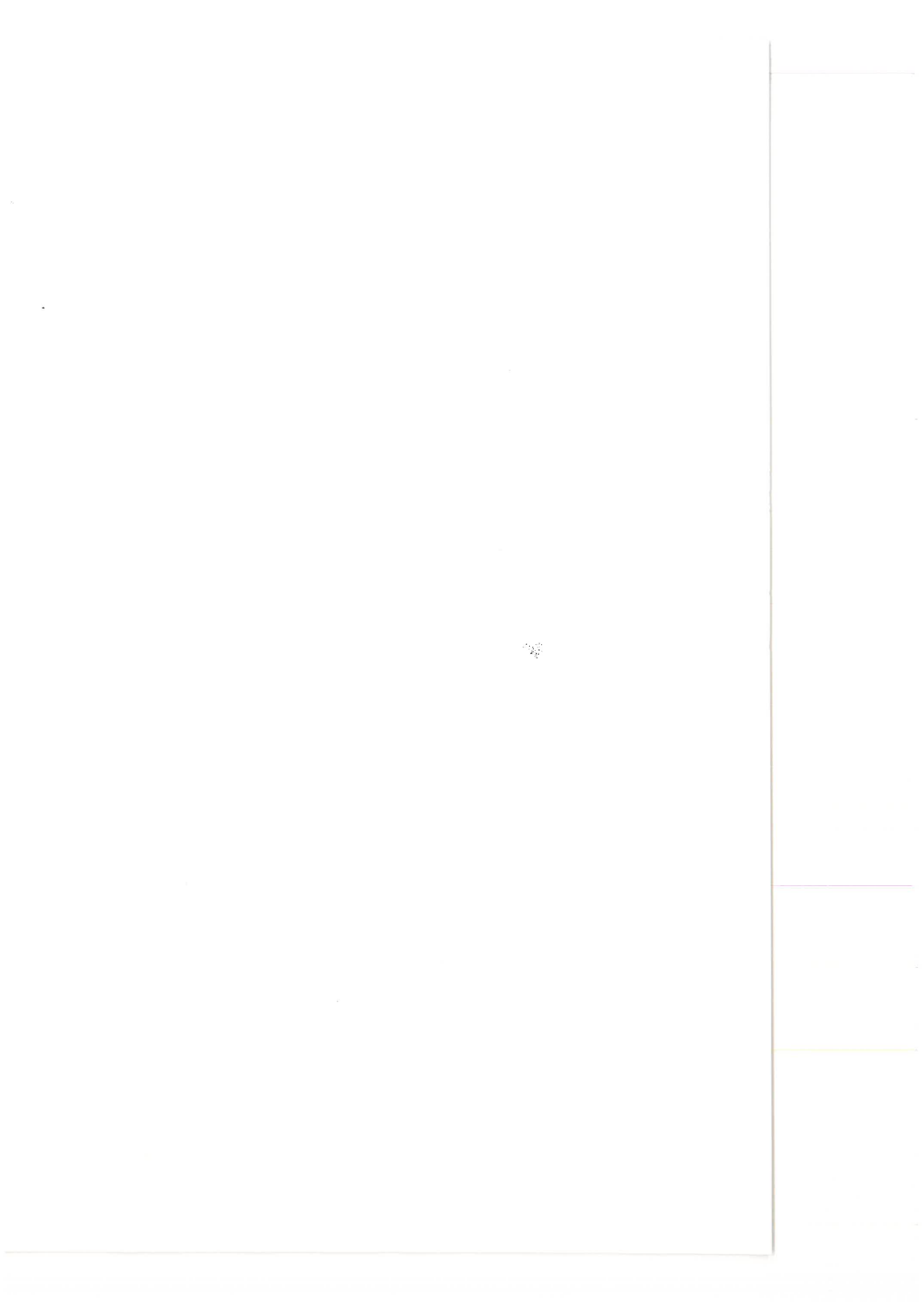
Instructing patients in physiotherapy: an example using three methods.

Rheumatology and Rehabilitation; 19, 1980, p. 91-94

Nivel (C 3654)

Wax baths and hand exercises are frequently prescribed for patients with rheumatoid arthritis and many patients seem to benefit from it. this study was initiated to ascertain the best way of instructing patients in these techniques at home.

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## 2. Exercise Therapy and Back Pain

ASH, C.J., BURNETT, T.H.

A new method of abdominal exercise.

Missouri Medicine; 86, 1989, no. 4, p. 213-216

KNAW

The authors describe a new form of sit-up exercise that should isolate the abdominal muscles and eliminate the hip flexors from participation. Such an exercise should be useful in low back pain rehabilitation programs. Demonstration of the sit-up in an L1 paraplegic man, along with measurements of intra-abdominal pressures generated during exercise are also included.

BAVIERA, B.

Rückenschulung: ein modernes Therapiekonzept.

Schweizerische Rundschau für Medizin Praxis; 80, 1991, no. 1/2, p. 5-14, 39

ref.

Nivel (C 3655)

The idea to teach a preventive program to patients with back pain is not new. To offer such a program to an entire nation in a comprehensive way is however a novelty. Mainly patients with back pain due to disturbed postural behaviour benefit from this offer. The basis for such campaigns resides in the notion about the plasticity, i.e. the response to training of the structures of the supporting apparatus and its controlling systems.

BIGOS, S.J., BATTIE, M.C.

Acute care to prevent back disability. Ten years of progress.

Clinical Orthopaedics and Related Research; 1987 Aug (221), p. 121-130, 97

ref.

Nivel (C 3656)

Efforts to curb back problems through pre-employment screening, safety measures, and educational programs have had little effect on this most expensive musculoskeletal malady. Present knowledge raises doubts about the possibility of preventing back pain. However, recent scientific investigations indicate that chronic back pain disability, which accounts for 80% of the costs for back problems, can be prevented. In Gothenburg, Sweden, the collective use of proven treatment methods during the acute stage of back symptoms markedly reduced the period of time patients were disabled from back problems. Effective early intervention centers around:

teaching patients about back care, including how to control symptoms through improved body mechanics; applying these educational principles, specifically to the patient's livelihood; avoiding the debilitation that results from overusing bed rest and medication; recommendations to increase cardiovascular fitness; and the judicious use of orthopedic surgery. This approach targets the few patients who tend to be disabled the longest, suffer the most, and become the most costly to society.

BLAIR, B.

Physiotherapy and back pain.

Occupational Health; 40, 1988, no. 9, p. 636-638

Nivel (C 3657)

The author tells how physiotherapists can help to deal in the management of back pain. The treatment should not stop when a patient walks out of the department door. The patient should be aware that his back is his own responsibility.

BOACHIE-ADJEI, O.

Conservative management of low back pain.

An evaluation of current methods.

Postgraduate Medicine; 84, 1988, 3, p. 127-133

Nivel (C 3658)

Most of the patients with low back pain recover within 6 to 12 weeks. Those who do not, however, represent a major challenge to physicians, who need to choose among many therapies for low back pain that have been advocated but in many cases not proven. For those with chronic low back pain, a functional restoration program and a multidisciplinary pain management program may prove effective.

DONCHIN, M., WOOLF, O., KAPLAN, L., FLOMAN, Y.

Secondary prevention of low-back pain. A clinical trial.

Spine; 15, 1990, no. 12, p. 1317-1320

KNAW

A clinical trial, aimed at secondary prevention of low-back pain, was performed in 142 hospital employees reporting at least three annual episodes of this condition. Participants were randomly assigned to one of three groups: a calisthenics program (CAL) for 3 months with biweekly sessions of flexion exercises, a back school program (5 sessions), and a control group. The effectiveness of the two intervention programs was evaluated over a 1-year period. Baseline pre-intervention data and evaluation at the end of 3 months of intervention and after an additional 6 months were



collected. A monthly surveillance for the whole year showed a mean of 4.5 "painful months" in the CAL group versus 7.3 and 7.4 months in the back school and control groups, respectively (p less than 0.0001). The superiority of the CAL group was achieved partly because of the significant increase in trunk forward flexion and to initial increment in abdominal muscle strength. The increased trunk flexion was associated with the rate of participation in the CAL sessions. Further research is needed to answer the question of "intensity versus type of exercise" by comparing different intervention programs, with similar intensity.

DONELSON, R.

The McKenzie approach to evaluating and treating low back pain. Orthopaedic Review; 19, 1990, no. 8, p. 681-686, 14 ref. Nivel (C 3659)

The McKenzie approach to evaluating and treating low back and neck pain is an interesting development in clinical medicine. A thorough mechanical assessment as described by McKenzie is informative and appropriate for all such patients and identifies an individualized self-treatment program that is often dramatically successful. Despite its world-wide use, this comprehensive discipline of evaluation and treatment is misunderstood or unappreciated by most medical practitioners. The assessment process and McKenzie's classification of low back pain syndromes (postural, dysfunctional, and derangement) are described. Therapeutic regimens emphasizing patient self-treatment for the current episode are presented, with the long-range goal of preventing recurrences.

ELNAGGAR, I.M., NORDIN, M., SHEIKHZADEH, A., PARNIANPOUR, M., KAHANOVITZ, N.

Effects of spinal flexion and extension exercises on low-back pain and spinal mobility in chronic mechanical low-back pain patients. Spine; 16, 1991, no. 8, p. 967-972  
KNAW

It has been estimated that one fourth to one half of all patients treated in physical therapy clinics suffer from low-back pain. The purpose of this study was to compare the effects of spinal flexion (Group I) and extension (Group II) exercises on low-back pain severity and thoracolumbar spinal mobility in chronic mechanical low-back pain patients. Both groups had significantly less low-back pain after treatment (P less than .10). There was no significant difference, however, between the spinal flexion and extension exercises in the reduction of low-back pain severity. The results indicated a significant difference between the groups in increasing the sagittal mobility (P less than .10). The results did not indicate any significant difference between and within groups in increasing

the coronal and transverse mobility of the thoracolumbar spine. Either the spinal flexion or extension exercises could be used to reduce chronic mechanical low-back pain severity, but the flexion exercises had an advantage in increasing the sagittal mobility within a short period of time.

ERNST, E.

Lumbago: Ruhe oder Bewegung?

Fortschritte der Medizin; 109, 1991, no. 13, p. 271-272, 21 ref.

Nivel (C 3660)

Today, its epidemic frequency makes back pain a major problem. Bed rest continues to be a common form of treatment. However, it also leads to a number of effects that must be considered negative in this situation. In contrast, physical exercise may, in principle, have a positive effect on a variety of functional systems. Controlled clinical studies show that bedrest, in particular if longer than two days, is of no advantage. Thus, these patients should be less often confined to bed, but, should instead be encouraged to take sensible physical exercise and accept more responsibility for their own health. A change in attitudes would appear desirable on the part both of the physician and the patient.

FOSTER, D.N., FULTON, M.N.

Back pain and the exercise prescription.

Clinics in Sports Medicine; 10, 1991, no. 1, p. 197-209, 48 ref.

Nivel (C 3661)

Rationale for the use of exercise in the treatment and prevention of low back pain (LBP) and injury has been discussed. Current knowledge supports the use of individualized exercise programs that emphasize the restoration and maintenance of adequate lumbar-spinal function. When indicated, aerobic exercises to develop overall fitness and prevent deconditioning should be included in the exercise prescription. Several commonly used exercises for strengthening the lumbar extensor muscles have been reviewed. Lumbar extension exercises that stabilize the pelvis provide a means for progressively increasing the resistance, and allow the person who performs exercises to move through a full range of lumbar movement appear to offer the greatest benefit to the patient with LBP.

GAUVIN, M.G., RIDDLE, D.L., ROTHSTEIN, J.M.

Reliability of clinical measurements of forward bending using the modified fingertip-to-floor method.

Physical Therapy; 70, 1990, no. 7, p. 443-447, 21 ref.

Nivel (C 3662)

The purpose of this study was to examine the reliability of measurements obtained with a modified version of the fingertip-to-floor method of assessing forward bending. With the modified fingertip-to-floor (MFTF) method, patients stand on a stool and bend forward so that measurements can be taken on patients who are able to touch the floor or reach beyond the level of the floor. Randomly paired physical therapists took repeated MFTF measurements on 73 patients with low back pain. Intraclass correlation coefficients (ICCs) were calculated for intratherapist and intertherapist reliability. The ICC value for intratherapist reliability was .98, and the ICC value for intertherapist reliability was .95. The results of this study suggest that measurements of forward bending obtained on patients with low back pain using the MFTF method are highly reliable.

GRAVES, J.E., POLLOCK, M.L., FOSTER, D., LEGGETT, S.H., CARPENTER D.M., VUOSO, R., JONES, A.

Effect of training frequency and specificity on isometric lumbar extension strength.

Spine; 15, 1990, no. 6, p. 504-509

KNAW

To investigate the effects of training frequency and specificity of training on isolated lumbar extension strength, 72 men (age = 31 +/- 9 years) and 42 women (age = 28 +/- 9 years) were tested before and after 12 weeks of training. Each test involved the measurement of maximum voluntary isometric torque at 72 degrees, 60 degrees, 48 degrees, 36 degrees, 24 degrees, 12 degrees, and 0 degrees of lumbar flexion. After the pretraining tests, subjects were randomly stratified to groups that trained with variable resistance dynamic exercise every other week (1x/2 weeks, n = 19), once a week (1x/week, n = 22), twice per week (2x/week, n = 23) or three times a week (3x/week, n = 21); a group that trained isometrically once a week (n = 14); or a control group that did not train (n = 15). Analysis of covariance showed that all training groups improved their ability to generate isometric torque at each angle measured when compared with controls (P less than 0.05). There was no statistical difference in adjusted posttraining isometric torques among the groups that trained (p greater than 0.05), but dynamic training weight increased to a lesser extent (p less than 0.08) for the 1x/2 weeks group (26.6%) than for the groups that trained 1x/week, 2x/week, and 3x/week (37.2 to 41.4%). These data indicate that a training frequency as low as 1x/week provides an effective training stimulus for the development of lumbar extension strength. Improvements in strength noted after isometric training suggest that isometric exercise provides an effective alternative for developing lumbar strength.

GRAVES J.E., POLLOCK, M.L., LEGGETT, S.H., CARPENTER, D.M., FIX, C.K., FULTON, M.N.

Limited range-of-motion lumbar extension strength training.

Medicine and Science in Sports and Exercise; 24, 1992, no. 1 , p. 128-133, 15 ref.

Nivel (C 3663)

The purpose of this study was to evaluate the effect of limited range-of-motion (ROM) resistance training on the development of lumbar extension strength through a 72 degrees ROM. Thirty-three men and 25 women (age = 30 +/- 11 yr) were randomly assigned to one of three training groups or a control group (C; n = 10) that did not train. Training was conducted once a week for 12 weeks and consisted of one set of 8-12 repetitions of variable resistance lumbar extensions until volitional fatigue. Group A (n = 18) trained from 72 degrees to 36 degrees of lumbar flexion; group B (n = 14) from 36 degrees to 0 degree of lumbar flexion; and group AB (n = 16) from 72 degrees to 0 degree of lumbar flexion. Prior to and after training, isometric lumbar extension torque was assessed at 72 degrees, 60 degrees, 48 degrees, 36 degrees, 24 degrees, 12 degrees, and 0 degree of lumbar flexion. Analysis of covariance showed that groups A, B, and AB increased lumbar extension torque (P less than or equal to 0.05) at all angles measured when compared with C. The greatest gains in torque were noted for groups A and B in their respective ranges of training but A and B did not differ from AB (P greater than 0.05) at any angle. These data indicate that limited ROM lumbar extension training through a 36 degrees ROM is effective for developing strength through 72 degrees of lumbar extension.

HARKAPAA, K., JARVIKOSKI, A., MELLIN, G., HURRI, H.

A controlled study on the outcome of inpatient and outpatient treatment of low back pain. Part I: Pain, disability, compliance, and reported treatment benefits three months after treatment. Part II: Effects on physical measurements three months after treatment.

Scandinavian Journal of Rehabilitation Medicine; 21, 1989, no. 2, p. 81-89, 33 ref.

Nivel (C 3664)

Outcome of inpatient and outpatient treatment of low back pain was studied in 459 patients (aged 35-54 years, 63% men); 156 inpatients, 150 outpatients and 153 controls. Changes in low back pain and in disability caused by it, and adherence and accomplishment of back exercises were used as short-term outcome criteria. The overall results showed a significant decrease in pain and disability and better compliance in the two treated groups when compared to the controls. There was also a significant difference in treatment gains between the inpatients and outpatients, i.e. the decrease in pain was greater and the frequency of back exercises

higher in the inpatients. The inpatients also estimated their treatment benefits more positively than the outpatients.

HURRI, H.

The Swedish back school in chronic low back pain. Part I. Benefits. Scandinavian Journal of Rehabilitation Medicine; 21, 1989, 1, p. 33-40  
KNAW

The aim of this 12-month follow-up study was to evaluate the effect of the Swedish-type back school in chronic low back pain. 188 subjects completed the study (95 in the treatment group and 93 in the control group). The following were assessed: 1) subjective scores of pain and disability. 2) clinical measurement and evaluation including spinal mobility and strength measurement. 3) number and length of sick-leaves.

At 12 months, subjective scores of pain and disability, and mobility of the lumbosacral section of the spine showed differences in the favour of the treatment group. There was no difference, however, in the number or the length of sick-leaves after the back school. It was concluded that patients with chronic or recurrent low back pain may get relief of subjective symptoms of low back pain from the back school. In addition to chronicity, there may be other factors affecting the outcome of treatment.

JACKSON, C.P.

Is there a role for exercise in the treatment of patients with low back pain. Clinical Orthopaedics and Related Research; 1983, no. 179, p. 39-45  
Nivel (C 3665)

JACKSON, C.P., BROWN, M.D.

Analysis of current approaches and a practical guide to prescription of exercise. Clinical Orthopaedics and Related Research; 1983, no. 179, p. 46-54, 68 ref.  
Nivel (C 3666)

Based on current information, aerobic exercises offer the greatest benefit to patients with back pain. Evidence supports the use of abdominal and extension exercises in a selected group of patients., but indications are limited, as are the useful types of exercises in both of these approaches. No support exists for the use of pre-printed handouts, which assume that every patient with back pain, regardless of clinical presentation, requires the same six or eight exercises. Rather, selectivity of exercises based on a thorough clinical evaluation is recommended. Use of a specific exercise should be governed by the sound scientific principles presented in this paper. Many other types of therapeutic exercises not mentioned in the present paper are currently utilized in the care of

patients with back pain.

JOYCE, K., BERKEBILE, C., HASTINGS, C., YARBORO, C., YOCUM, D.  
Health status and disease activity in systemic lupus erythematosus.  
Arthritis Care and Research; 2, 1989, no. 2, p. 65-69, 19 ref.  
Nivel (C 3667)

The physical manifestations of disease activity and health status of patients with systematic lupus erythematosus (SLE) were measured in this study. Forty-nine patients completed the Arthritis Impact Measurement Scale (AIMS) and consented to examination for physical features of SLE, documented by a Clinical Activity Index (CAI). Results showed a mean score of 22 on the AIMS and 6.6 on the CAI. The total scores for each measure were significantly correlated ( $r = 0.55$ ,  $p$  less than 0.001), indicating a relationship between health status and clinical disease activity. The total score for CAI was significantly correlated with the physical activity, pain, and depression subscales of health status. The total score for health status was significantly correlated with mucocutaneous, musculoskeletal, and general features of CAI. Within scale correlations were also found. Mucocutaneous aspects of disease activity were significantly correlated with pain and depression. Musculoskeletal features were significantly correlated with physical activity and pain. General aspects of SLE, including fatigue, were significantly correlated with physical activity. The study concludes that there is a relationship between certain physical features of SLE and key components of health status.

KAHANOVITZ, N., NORDIN, M., VERDERAME, R., YABUT, S., PARNIANPOUR, M., VIOLA, K., MULVIHILL, M.  
Normal trunk muscle strength and endurance in women and the effect of exercises and electrical stimulation. Part 2: Comparative analysis of electrical stimulation and exercises to increase trunk muscle strength and endurance.  
Spine; 12, 1987, no. 2, p. 112-118, 27 ref.  
Nivel (C 3668)

Several studies have shown positive correlations between muscle strength, flexibility, and the frequency of low-back pain. Weak trunk musculature and decreased endurance have thereby come to be identified as significant risk factors in the development of occupational back problems. Because it is widely accepted that exercise plays an important role in the conservative treatment and prevention of low back pain, the goals of most rehabilitative programs involve improving the strength and endurance of the low-back pain patient. Whereas electrical stimulation has been shown to increase the muscle strength of the lower extremities, this effect has not been demonstrated for the trunk muscles. Part 2 is a prospective controlled study designed to document and to compare the effects

of electrical stimulation and exercise on trunk muscle strength. A total of 117 healthy women were divided randomly into four groups. Two groups received electrical stimulation with different electrical parameters, one group received exercises, and one group acted as a control group. The results showed that low-frequency electrical stimulation and exercises significantly ( $p$  less than .05) increased isokinetic back-muscle strength compared to the control and medium-high-frequency electrical stimulation groups. Both types of electrical stimulation, however, significantly increased ( $p$  less than .05) the endurance in the back muscles compared with the control and the exercise groups. This study showed that electrical stimulation may be a valuable treatment in the early care of low-back pain patients in maintaining and increasing strength and endurance of back muscles when a more active exercise program is too painful to perform.

KEANE, G.P., SAAL, J.A.

The sports medicine approach to occupational low back pain.

Western Journal of Medicine; 154, 1991, no. 5, p. 525-527

KNAW

Absenteeism caused by low back pain costs industry millions of dollars a year. Innovative approaches for the prevention and treatment of low back pain in workers are mandatory. The sports medicine approach for aggressive rehabilitation offers a possible solution.

KELLETT, K.M., KELLETT, D.A., NORDHOLM, L.A.

Effects of an exercise program on sick leave due to back pain.

Physical Therapy; 71, 1991, no. 4, p. 283-291; discussion p. 291-293, 22 ref.

Nivel (C 3669)

The purposes of this study were to evaluate the effect of a weekly exercise program on short-term sick leave (less than 50 days) attributable to back pain and to determine whether changes in absenteeism were related to changes in cardiovascular fitness. Subjects were randomly assigned to an exercise group ( $n = 58$ ) and a control group ( $n = 53$ ). Sick leave attributable to back pain was determined in the intervention period of 1 1/2 years and a comparable 1 1/2-year period prior to the study. In the exercise group, the number of episodes of back pain and the number of sick-leave days attributable to back pain in the intervention period decreased by over 50%. Absenteeism attributable to back pain increased in the control group. The decrease in sick leave in the exercise group was not accompanied by any change in cardiovascular fitness. Suggestions for establishing exercise programs are given.

KLEIN, R.G., EEK, B.C.

Low-energy laser treatment and exercise for chronic low back pain: double-blind controlled trial.

Archives of Physical Medicine & Rehabilitation; 71, 1990, no. 1, p. 34-37, 11 ref.

Nivel (C 3670)

Twenty patients with chronic low back pain were enrolled in a randomized double-blind trial to test the efficacy of low-energy laser biostimulation combined with exercise. Ten patients received low-energy gallium-arsenide laser treatment, and ten received placebo laser treatment. Both groups were also placed on an active exercise program. Visual analogue and disability pain scores were assessed pretreatment and one month posttreatment and showed significant ( $p$  less than .02) improvements in both groups, but no relative advantage was found for either group. Objective parameters using computerized triaxial measurements of range of motion, isometric torque, and isodynamic velocity were also performed before and after treatment. There were significant improvements in objective parameters in both the laser and placebo groups, but no relative advantage accrued to either group. Under the conditions of this study, low-energy laser stimulation plus exercise did not provide a significant advantage over exercise alone.

KOES, B.W., BOUTER, L.M., BECKERMAN, H., HEIJDEN, G.J. VAN DER, KNIPSCHILD, P.G.

Physiotherapy exercises and back pain: a blinded review.

BMJ; 302, 1991, no. 6792, p. 1572-1576, 37 ref.

Nivel (C 3671)

The objective was to determine the quality of randomised controlled trials of exercise therapy for back pain with the help of a computer aided search of published papers and a blinded assessment of the methods of studies. Subjects were 23 randomised controlled trials, of which 16 studied exercise therapy given by physiotherapists to individual patients with back pain. Other conservative treatments could be included. Only four studies scored more than 50 points (maximum 100), indicating that most were of poor quality. In six studies it was found that exercise was better than reference treatments and 10 reported it to be no better or worse than the reference treatment. Those reporting positive results tended to have higher methods scores (4/6 positive v 4/10 negative scored greater than or equal to 42). Conclusions: no conclusion can be drawn about whether exercise therapy is better than other conservative treatments for back pain or whether a specific type of exercise is more effective. Further trials are needed in which greater attention is paid to methods of study.



KOHLES, S., BARNES, D., GATCHEL, R.J., MAYER, T.G.

Improved physical performance outcomes after functional restoration treatment in patients with chronic low-back pain. Early versus recent training results.

Spine; 15, 1990, 12, p. 1321-1324, 24 ref.

Nivel (C 3672)

Functional restoration, an approach by treatment of a medically supervised team that addresses deficits that accompany the deconditioning process in patients with chronic low-back pain, has emerged as a viable rehabilitation alternative. While the primary emphasis of this treatment approach has remained unchanged since its inception over 6 years ago, recent rapid advances in quantification technology and in understanding the complexity of the chronic low-back pain (CLBP) syndrome, have led to more sophisticated and aggressive rehabilitation efforts. In the current study, the authors examined two groups of patients with CLBP, from the treatment program's initial (n = 45) and most recent years (n = 57) of operation, respectively, to determine if the evolution of the treatment program has resulted in increased gains in physical capacity between these groups of patients. Patients in each group were assessed on measures of isokinetic trunk strength and spinal range of motion at program admission and discharge. Both groups demonstrated improved physical capacity levels, but the recent group also demonstrated considerably higher physical capacity levels than the early group, at both program admission and discharge. It was concluded that functional restoration continues to be successful with CLBP patients, and that increased preprogram training and education may facilitate a more rapid elimination of inhibitory factors (i.e. pain, fear of getting injured again), which often impede and slow down physical training.

KUMAR, S.

Cumulative load as a risk factor for back pain.

Spine; 15, 1990, no. 12, p. 1311-1316, 50 ref.

Nivel (C 3673)

The association between cumulative load (biomechanic load and exposure time integral over the entire work experience) and back pain was investigated in a group of institutional aides with physically stressful jobs. A questionnaire/interview was conducted with 161 of these institutional aides. The point prevalence of back pain in this sample was 62%. Men had worked a mean duration of 14.3 years and women 11.6 years at the time of the onset of the first pain episode. Every job performed was analyzed by the use of a two-dimensional static mathematical model. The compression and shear at the thoracolumbar and lumbosacral discs were computed by the use of a biomechanic model. Cumulative compression and shear were significantly higher in institutional aides with pain com-

pared with those without pain ( $p$  less than 0.05-0.01). The pain group was similar to the no-pain group in age, weight, and height.

LEE, C.K.

Office management of low back pain.

Orthopedic Clinics of North America; 19, 1988, no.4, p. 797-804, 20 ref.

Nivel (C 3674)

Low back pain, with or without sciatica, is a very common medical problem. Since a great majority of patients can be successfully treated with nonoperative methods, office management of these patients is a very important issue for all clinicians. Patients with low back pain can be divided into three major groups: 1) the first group with acute (initial onset or very occasional recurrent) symptoms, 2) the second group with chronic (frequent intermittent recurrent or persistent) symptoms and 3) the third group with resistant symptoms.

For the first group with acute symptoms, establishment of a specific diagnosis is rarely necessary. An active nonoperative treatment program (brief rest, protection, physical therapy modalities, medication, exercises, and reconditioning) provides a high rate (nearly 90 to 95 per cent) of success (return to normal activities and work) within 8 to 12 weeks. For the second group, with chronic symptoms, establishment of a specific diagnosis and a comprehensive and specific history are essential. Diagnostic procedures for specific pathologic conditions are outlined. A clear and specific treatment goal should be established and communicated to all the parties involved. Nonoperative treatment for this group includes back school, postural exercises, bracing, exercises for strength and endurance, work-site modification, vocational counseling, and pain management. For the third group with resistant symptoms, the role of the orthopedic or neurosurgeon is as a consultant to a pain management team for evaluation and treatment of missed diagnosis or complications of previous treatments.

LEE, C.K.

The use of exercise and muscle testing in the rehabilitation of spinal disorders. Clinics in Sports Medicine; 5, 1986, 2, p. 271-276

KNAW

The isokinetic evaluation of trunk muscle strength (maximal and fatigue) provides very valuable information for establishing specific exercise programs for patients with low back disorders, and for preventing low back injury in industry by identifying employees with weak trunk muscles and with job-strength mismatches.

LEHTO, T.U., HELENIUS, H.Y., ALARANTA H.T.

Musculoskeletal symptoms of dentists assessed by a multidisciplinary approach. Community Dentistry and Oral Epidemiology; 19, 1991, no. 1, p. 38-44, 39 ref.

Nivel (C 3675)

Musculoskeletal health was studied as part of a comprehensive health examination in 131 professionally active dentists. 42% of these dentists had experienced pain and disability (interference with daily activities) by neck-shoulder problems during the preceding year, with a tendency to greater prevalence in salaried dentists than in private practitioners. For the lower back, this percentage was 37. Somatic symptoms of stress, perceiving dentistry as physically too heavy or mentally too straining and a poorer general health status rating were all associated with a greater 1 year prevalence of neck-shoulder and lower back pain and disability and with poorer general physical fitness. Age, weekly work hours, working posture, use of an assistant, or radiographic degenerative changes in the dentist's skeleton were not associated with 1 year prevalence of neck-shoulder or lower back pain and disability. The results provide evidence that physical exercise should be recommended to dentists and might also be applicable to subjects in other occupations with similar requirements.

LIEMOHN, W.

Exercise and arthritis. Exercise and the back.

Rheumatic Disease Clinics of North America; 16, 1990, no. 4, p. 945-970, 66 ref.

Nivel (C 3676)

Some of the positive benefits from participating in aerobic activity have already been addressed. However, an individual's ability to participate in many aerobic activities may be contingent on the ability to maintain a neutral or a stabilized spine. For example, the individual for whom jogging has been painful may be able to jog after he or she has learned trunk stabilization and is able to keep the spine in his or her pain-free position. Although Williams contended that jogging was an inappropriate activity for the individual with a low-back problem, contrary to this notion, White believes that jogging is more apt to protect a person from low-back pain than to cause it. Although no association was found between mileage run and osteoarthritis, jogging is not appropriate for all individuals who present with low back pain or related arthritic conditions. Moreover, poor biomechanics in running can exacerbate existing low-back problems as well as bring about new ones as compensatory adaptations are made. For example, poor running technique might include excessive forward lean; this must be counterbalanced by contraction of the back extensors, which then may become overly tired or produce high intersegmental forces on

the discs. The authors advocate an upright posture with minimal forward lean. The biomechanics of running also are most important from the perspective of shock absorption. Factors to consider in addition to running within the neutral spine excursion include cushioning footstrike by "giving" at the ankle, knee, and hip joints. In addition to good biomechanics, it would also be important to use an excellent quality training shoe and to run on a soft track as opposed to harder surfaces; hills should probably be avoided for most symptomatic individuals until they become strong. Nachemson indicates that in addition to recommending jogging for low back pain, he most commonly recommends backstroke swimming, brisk walking, and stairclimbing. Bicycle riding (stationary or actual) would be another good activity. In conclusion, although exercise is by no means a panacea, it very well may be nature's elixir that will enable some individuals beset by mechanical problems of the back to assume a more active and enjoyable life.

MANDEL, J.H., LOHMAN, W.

Low back pain in nurses: the relative importance of medical history, work factors, exercise, and demographics.

Research in Nursing & Health; 10, 1987, no. 3, p. 165-170, 15 ref.

Nivel (C 3677)

Although low back pain (LBP), a major problem for nurses, is presumed to be caused by the physical demands of work, little scientific information supports this view. In this study, registered nurses were surveyed regarding LBP, demographics, medical history, exercise, and work variables. Univariate and multivariate analyses indicated previous LBP or back pain in another location of the spine and were strongly associated with LBP during the study year. Aerobic dance exercise was less strongly associated. In contrast, lifting patients was only weakly associated with low back pain, and other occupational variables not at all. Although results must be interpreted cautiously in light of study limitations, the findings suggest that factors unrelated to work may be more important to LBP than previously thought.

MANNICHE, C., HESSELSON, G., BENTZEN, L., CHRISTENSEN, I., LUNDBERG, E.

Clinical trial of intensive muscle training for chronic low back pain.

Lancet; 1988, dec 24/31, p. 1473-1476, 35 ref.

Nivel (C 3678)

105 patients who had chronic low back pain without clinical signs of lumbar nerve root compression or radiological evidence of spondylolysis or osteomalacia were randomised to three treatments: 30 sessions of intensive dynamic back extensor exercises over three months, a similar programme at one-fifth of the exercise

intensity, or one month of thermotherapy, massage, and mild exercises. The results consistently favoured intensive exercise, which had no adverse effects. Since these exercises can be conducted in groups, the intensive programme is no more costly than conventional strategies that require individual attention.

MANNICHE, C., LUNDBERG, E., CHRISTENSEN, I., BENTZEN, L., HESSELSON, G.  
Intensive dynamic back exercises for chronic low back pain: a clinical trial.  
*Pain*; 47, 1991, no. 1, p. 53-63  
Nivel (C 3679)

The effect of intensive dynamic back extensor exercises for patients with chronic low back pain was investigated in a controlled clinical trial in which chronic low back pain patients underwent a 3-month intensive training program with a total of 30 sessions. The 105 patients were divided into 3 groups: a treatment group, an alternative group which underwent 1/5 of the treatment group's exercise program per session, and an alternative group in which treatment consisted of thermotherapy, massage and mild exercise. Regardless of whether the treatment outcome is assessed qualitatively or quantitatively, a statistically significant, favorable difference was found between the results for the treatment group and for the alternative groups at conclusion and at the 3-month follow-up. It appeared from the quantitative assessment that patients in the treatment group who completed the training program at least once a week for the entire 1-year follow-up period were the only patients with a significantly better back status after 1 year compared to the time of inclusion. Irrespective of sex, age, duration and degree of severity of back trouble, or of pre-existing sciatica or pathological findings upon X-ray of the spine, patients obtained a favorable result from the training program. The therapy was found to be without risk, but patients with clinical signs of current lumbar nerve root compression or radiological signs of spondylolysis or spondylolisthesis of the spine were excluded from the study.

MARTIN, P.R., ROSE, M.J., NICHOLS, P.J., RUSSELL P.L., HUGHES, I.G.  
Physiotherapy exercises for low back pain: process and clinical outcome.  
*International Rehabilitation Medicine*; 8, 1986, p. 34-38, 13 ref.  
Nivel (C 3680)

This study was designed to assess whether physiotherapy exercises administered for low back pain have the physiological effects that they purport to have (increase spinal mobility and muscle strength) and whether these effects are of clinical relevance (related to changes in pain and function). Thirty-six patients were allocated to three treatment conditions, mobilizing exercises, isometric exercises or an attention-placebo control procedure. The results did not

support the hypotheses concerning the effects of physiotherapy exercises, and hence challenge widely held views concerning the mechanism by which some patients suffering from low back pain improve whilst undergoing physiotherapy exercises.

MAYER, T.G., BARNES, D., NICHOLS, G., KISHINO, N.D., COVAL, K., PIEL, B., HOSHINO, D., GATCHEL, R.J.

Progressive isoinertial lifting evaluation. II. A comparison with isokinetic lifting in a disabled chronic low-back pain industrial population.

Spine; 13, 1988, no. 9, p. 998-1002, 27 ref.

Nivel (C 3681)

The Progressive Isoinertial Lifting Evaluation (PILE), as described in Part I of this series of articles, is a simplified test combining psychophysical and isoinertial protocols to provide an unconstrained lifting assessment. In the second part of this study, 100 chronically disabled low-back pain patients (57 men and 43 women) were studied at two points: 1) at initial evaluation, when referred for possible entry into a comprehensive Functional Restoration treatment program; and 2) at the conclusion of the treatment (an average 7 weeks later).

Results of simultaneous lumbar PILE and Cybex Lifttask (Lumex, Ronkonkoma, NY) tests are presented, showing that patients may frequently double or triple initial lifting capacity after undergoing the functional restoration training program, achieving lifting levels at or above normal for incumbent industrial workers. Overall, results demonstrate that the PILE test can be an effective baseline screening test for lifting capacity under certain circumstances. Although several drawbacks affecting the PILE as an isolated test are discussed, its usefulness as part of a battery of physical capacity tests making up a quantitative functional evaluation is clearly demonstrated. Finally, the potential use of PILE as a safe, inexpensive, simple, and relevant screening test for frequent lifting capacity in worker selection is discussed.

MELLIN, G., HURRI, H., HARKAPAA, K., JARVIKOSKI, A.

A controlled study on the outcome of inpatient and outpatient treatment of low back pain. Part II. Effects on physical measurements three months after treatment.

Scandinavian Journal of Rehabilitation Medicine; 21, 1989, no. 2, p. 91-95, 19 ref.

Nivel (C 3682)

Inpatient and outpatient treatments were compared with a control intervention in 288 men and 168 women, aged 35-54, who were at work, but suffered from chronic or recurrent low back pain. Physical measurements and back pain assessments were carried out before the intervention and at a 3-month follow-up. Physical fitness

improved most in the inpatients, but the outpatients did not differ from the controls. Correlations between back pain and physical measurements indicated that increase of lumbar and hip mobility was more important than increase of trunk strength for subjective progress in these patients. Increased trunk extension strength correlated significantly with subjective progress in women, who also had higher correlations between improved physical fitness and progress than men.

MELLIN, G., HARKAPAA, K., HURRI, H., JARVIKOSKI, A.

A controlled study on the outcome of inpatient and outpatient treatment of low back pain. Part IV. Long-term effects on physical measurements.

Scandinavian Journal of Rehabilitation Medicine; 22, 1990, no. 4, p. 189-194, 13 ref.

Nivel (C 3683)

Effects of inpatient and outpatient treatment on physical measurements in chronic low back pain patients (n = 476) were analyzed at 1.5- and 2.5-year follow-ups as well as 3 months after a refresher program which was carried out 1.5 years after the first treatment. Physical measurements consisted of hip and lumbar spinal mobility, and trunk muscle strength. At the 1.5-year follow-up the two treatment groups did not differ from the control group, but at the 2.5-year follow-up inpatients showed better improvements in physical functions from the pretreatment level. The refresher treatment was found to improve physical functions more effectively than the first treatment program, especially in the outpatients. Self-care with heavy exercising was related with the improvement of physical functions, but back exercises and light exercising were not. Statistically significant but modest correlations were found between improved physical functions and subjective progress during the long-term follow-ups.

MITCHELL, R.I., CARMEN, G.M.

Results of a multicenter trial using an intensive active exercise program for the treatment of acute soft tissue and back injuries.

Spine; 15, 1990, no. 6, p. 514-521

KNAW

Dissatisfaction with current nonsurgical treatment of acute soft tissue and back injuries initiated a search for more effective treatment. A multicenter trial, involving 12 clinics, treated 1,072 patients. Treatment consisted of intensive, time-limited exercises emphasizing mobility, muscle strengthening, work conditioning, sequence training, and appropriate education sessions. Return to full-time work was seen as proof of the fact that the patient had recovered fully. Time off work and compensation costs were parameters used to evaluate the results. A detailed study of 703 patients treated at five

clinics, operational for more than 12 months, showed superior results when compared with the comparison group of 2,172 matched control subjects. The treatment group returned to work earlier and realized substantial cost savings. This treatment program has proved to be superior to the miscellaneous variety of treatment modalities used for acute soft tissue and back injuries provided to the comparison group.

MORRISON, G.E., CHASE, W., YOUNG, V., ROBERTS, W.L.  
Back pain: treatment and prevention in a community hospital.  
Archives of Physical Medicine & Rehabilitation; 69, 1988, no. 8, p. 605-609,  
24 ref.  
Nivel (C 3684)

Because back pain is a widespread and costly condition that tends to recur, treatment must focus on both the amelioration of acute symptoms and prevention over the long term. This paper reports a longitudinal evaluation of a program from a community hospital that emphasizes both these aspects. One hundred and twenty patients routinely admitted to this program were randomly assigned to treatment and control groups. These groups were assessed for differences in demonstrated physical strength, mobility, body mechanics, and self-care knowledge, and in levels of self-reported exercise, anxiety, and pain. There were significant immediate gains on physical measures of fitness and in observed body mechanics. Patients also reported significant gains in physical capabilities at home and in leisure activities. Self-care knowledge also improved. After assessment one year later it turned out that original gains in physical strength and mobility were being maintained, and self-reported physical capabilities also remained high. Although demonstrated knowledge of correct body mechanics declined over this period, it was still significantly greater than before the program. In the light of these results, the authors believe that outpatient programs like the one reported here deserve careful consideration in an era of concern about rising costs for primary health care.

NACHEMSON, A.  
Recent advances in the treatment of low back pain.  
International Orthopaedics; 9, 1985, no. 1, p. 1-10  
KNAW

There is at present an epidemic of low back pain in the industrialized countries. Although the exact origin of such pain is still unknown, there is increasing awareness that the outcome is usually favourable. Only some 10% of those suffering an acute episode of back pain are incapacitated for more than 6 weeks. The causes of long standing back pain are being identified in an increasing number of patients. They include anatomical and pathological



disturbances in the motion segment as well as psychological, social and political causes. There are numerous factors which influence the pathophysiology of the motion segment. The degree of loading has been successfully measured and delineated for various postures and exercises, including those at work. The nutritional pathways to the disc have been established and the effect of various external factors measured. Movement is good for the disc and the importance of continuous passive motion for the healing of diseased or injured connective tissues is not established. Activation of large muscle groups increases the production of the body's pain reducing encephalins. Early diagnosis and early mobilisation of the patient should be of benefit, and long term bed rest and inactivity must be prevented. Fewer cases will need operation in the future. Improved imaging techniques and better methods of operation and fixation will help those few who have a definite pathological lesion amenable to surgery.

OLAND, G., TVEITEN, G.

A trial of modern rehabilitation for chronic low-back pain and disability. Vocational outcome and effect of pain modulation.

Spine; 16, 1991, no. 4, p. 457-459, 27 ref.

Nivel (C 3685)

Of 66 nonoperated low-back pain patients who entered a 4-week program of modern active rehabilitation after 13 months' sick leave, only 15 (23%) had returned to work at 18 months' follow-up. Effective pain modulation with pool traction did not influence the vocational status or pain level at the time of follow-up. The prevalence of blue-collar workers among the clients were doubled compared with the general population, and a high proportion were unskilled (71%). It is concluded that the resources of health services should be used in the subacute stage to produce an earlier and more precise organic and psychosocial diagnosis and to state the preference of an active attitude supported by general physical training.

ONGLEY, M.J., KLEIN, R.G., DORMAN T.A., EEK, B.C., HUBERT, L.J.

A new approach to the treatment of chronic low back pain.

Lancet; 1987, no. 8551, Jul 18, p. 143-146, 19 ref.

Nivel (C 3686)

81 patients with chronic low back pain (average duration 10 years) were randomised to two treatment groups. 40 received an empirically devised regimen of forceful spinal manipulation and injections of a dextrose-glycerine-phenol ("proliferant") solution into soft-tissue structures, as part of a program to decrease pain and disability. The other 41 patients received parallel treatment in which the main differences were less extensive initial local anaesthesia and manipu-

lation, and substitution of saline for proliferant. Neither patients nor assessors knew which treatment had been given. When assessed by disability scores the experimental group had greater improvement than the control group at one ( $p$  less than 0.001), three ( $p$  less than 0.004), and six ( $p$  less than 0.001) months from the end of treatment; at six months an improvement of more than 50% was recorded in 35 of the experimental group versus 16 of the control group and the numbers free from disability were 15 and 4, respectively ( $p$  less than 0.003). Visual analogue pain scores and pain diagrams likewise showed significant advantages for the experimental regimen.

OVERMAN, S.S., LARSON, J.W., DICKSTEIN, D.A., ROCKEY, P.H.

Physical therapy care for low back pain. Monitored program of first-contact nonphysician care.

Physical Therapy; 68, 1988, no. 2, p. 199-207, 25 ref.

Nivel (C 3687)

The authors studied the process and outcomes of physical therapist management of 107 patients with low back pain at a walk-in clinic. Sixty-seven patients with low back pain concurrently were randomly assigned to internists at the clinic. Physicians and physical therapists recorded baseline clinical data and management plans on standard check lists. Physical therapists used a validated algorithm that directed diagnostic evaluations and physician consultations, but all other physical therapist treatment decisions were unconstrained. Patients in the physical therapist and physician groups did not differ significantly. Physical therapists referred more patients to the physical therapy department than did physicians but recommended muscle relaxants, prescription analgesics, and bed rest less frequently. The occurrence of new symptoms, duration of symptoms, and duration of activity limitations were similar between the physician and physical therapy patient groups at a one-month follow-up examination. Physical therapist-managed patients expressed greater satisfaction than physician-managed patients with several aspects of their care. The percentage of functional improvement for highly dysfunctional patients was significantly greater for the physical therapist-managed patients than for the physician-managed patients. The implications of a physical therapist first-contact care program for health service organizations, health care policy, physical therapist training, and credentialing are discussed.

PRUITT, C.O.

Exercises for prevention and alleviation of back pain.

General Dentistry; 36, 1988, no. 3, p. 199-204, 18 ref.

Nivel (C 3688)

The incidence of back and neck pain among dentists is consider-

able. More than one out of every two individuals experiences such pain. The problem is discussed and an anatomical description is given to illustrate some reasons for the problem that practitioners experience. Finally, a program of exercises is presented, which, when performed consistently three times a week and once in weekends, is both therapeutic and preventive.

REILLY, K., LOVEJOY, B., WILLIAMS, R., ROTH, H.

Differences between a supervised and independent strength and conditioning program with chronic low back syndromes.

Journal of Occupational Medicine; 31, 1989, no. 6, p. 547-550

Nivel (C 3689)

The purpose of this study was to evaluate changes in physiologic parameters seen in a group of patients with chronic low back syndrome assigned to supervised and independent strength and conditioning programs. Forty patients with chronic low back syndrome were assigned either to a control group (independent exercise) or to an experimental group (supervised exercise). All subjects underwent pre-testing for aerobic fitness, strength and responses to visual analog pain rating scales. Twenty control subjects were given predesigned exercise programs and told to exercise four times a week for 6 months. Twenty experimental subjects were given predesigned exercise programs but were monitored by a strength and conditioning specialist for the same period. Statistically significant results were seen for increases in aerobic fitness and strength, decreases in reported pain, and body fat percentage in the experimental group. Since the experimental group completed 90.75 sessions out of 96, compared with 31.95 for the control group, it could be concluded that supervision increases chances for compliance and success as measured by these parameters.

ROBB-NICHOLSON, L.C., DALTRY, L., EATON, H., GALL, V., WRIGHT, E., HARTLEY, L.H., SCHUR, P.H., LIANG, M.H.

Effects of aerobic conditioning in lupus fatigue: a pilot study.

British Journal of Rheumatology; 28, 1989, no. 6, p. 500-505, 26 ref.

Nivel (C 3690)

Fatigue, is a complex symptom, which significantly affects the quality of life in many patients with systemic lupus erythematosus (SLE). To understand this phenomenon, 23 patients with SLE and fatigue were studied. Standardized tests of depression (NIMH), fatigue, exercise tolerance (ETT) on a bicycle ergometer, and SLE activity were obtained. At baseline, SLE patients had significantly lower maximum oxygen consumption (VO<sub>2</sub> max) than normals (p less than 0.005). Adjusted for age and sex, SLE patients perform at 54% of their expected maximum VO<sub>2</sub>, which is similar to published

data from patients with rheumatoid arthritis. Depression by NIMH was not correlated with VO<sub>2</sub> max or length of time on ETT. Fatigue measured by Profile of Mood States (POMS) was correlated with ETT time ( $r = 0.476$ ,  $p$  less than 0.025) and with VO<sub>2</sub> max ( $r = -0.402$ ,  $p$  less than 0.07). After an 8-week aerobic conditioning program the experimental group increased their aerobic capacity by 19% in contrast to 8% in controls. This change correlated with decreased fatigue as measured by visual analogue scales. Exercise did not exacerbate disease, and only two of 16 experimental subjects experienced transient joint symptoms during exercise.

SIKORSKI, J.M.

A rationalized approach to physiotherapy for low-back pain.

Spine; 10, 1985, no. 6, p. 571-579, 19 ref.

Nivel (C 3691)

A systematic approach to low-back pain is presented that relies on the classification of patients according to their symptoms. Rational systems of physiotherapy are proposed for each group and incorporated into an algorithm. One hundred forty-two patients with mechanical low-back pain have been treated, and their response has been assessed by means of a postal questionnaire. Patients were offered an educational program, exercises, spinal manipulation, spinal supports, and analgesic medication. Eighteen percent of these patients became completely free of pain, and 59% experienced a reduction in pain level. The most effective treatment was education in back care, followed closely by an exercise program. The responses were different in the various subgroups, and a series of revised flow charts is presented.

SINAKI, M., LUTNESS, M.P., ILSTRUP, D.M., CHU, C.P., GRAMSE, R.R.

Lumbar spondylolisthesis: retrospective comparison and three-year follow-up of two conservative treatment programs.

Archives of Physical Medicine and Rehabilitation; 70, 1989, 8, p. 594-598

Nivel (C 3692)

Forty-eight patients with symptomatic back pain secondary to spondylolisthesis who were treated conservatively, were followed for three years after initial examination to compare the outcomes of two exercise programs. The patients were divided into two groups, those doing flexion and those doing extension back strengthening exercises. All patients received instructions on posture, lifting techniques, and the use of heat for relief of symptoms. After three months, only 27% of all patients who were instructed in flexion exercises had moderate or severe pain and only 32% were unable to work or had limited their work. Among the patients who were instructed in extension exercises, 67% had moderate or severe pain and 61% were unable to work or had limited their work. At three-

year follow-up, only 19% of the flexion group had moderate or severe pain and 24% were unable to work or had limited their work. The respective figures for the extension group were 67% and 61%. The overall recovery rate after three months was 58% for the flexion group and 6% for the extension group. At three years these figures improved to 62% for the flexion group and dropped to 0% for the extension group. On the basis of these findings, the authors suggest that if a conservative treatment program is elected, back flexion or isometric back strengthening exercises should be considered. The three-year follow-up data presented here seem to lend support to this point of view.

SMIDT, G.L., BLANPIED, P.R., ANDERSON, M.A., WHITE, R.W.  
Comparison of clinical and objective methods of assessing trunk muscle strength: an experimental approach.  
Spine; 12, 1987, no. 10, p. 1020-1024  
KNAW

An objective method was used to evaluate the validity of the sit-up, prone trunk extension, and double leg lowering clinical tests. Normal men and women and patients with a history of backache served as subjects. The vast majority of the subjects were able to perform the Grade 1 level, which was the highest resistance imposed by the sit-up and prone extension tests. The double leg lower was superior to the other two clinical tests but was able to identify only broad differences in strength capability. In the main, the subjective clinical tests were poor discriminators and seemed to lack the range of resistance necessary to be definitively useful as methods of assessing trunk muscle strength and may not provide appropriate resistance for improving trunk muscle strength in most patients.

SMIDT, G.L., BLANPIED, P.R.  
Analysis of strength tests and resistive exercises commonly used for low-back disorders.  
Spine; 12, 1987, 10, p. 1025-1034  
Nivel (C 3693)

Using a modeling approach, the conventional sit-up, the double straight-leg lowering, and the prone trunk extension, are shown to have limitations as tests of maximum trunk flexion and extension strength and as modes of resistive exercise. These maneuvers are poor discriminators of trunk muscle strength, and they lack the range of resistance necessary to cover the spectrum of human trunk muscle strength capability. Use of manually handled weights can improve the above clinical tests and resistive exercise methods. As a result of selective positioning of the weights, variable resistance above and below that provided by the body segments alone

can be achieved. The partial sit-up may be appropriate only for patients with significant trunk flexion weakness, and the straight head-trunk sit-up may be useful as a more strenuous test and resistive exercise. Rationale and derivations of the rigid-body equilibrium equations, as well as some of the limitations and assumptions associated with the modeling approach, are presented.

SMITH, R.L., MELL, D.B.

Effects of prone spinal extension exercise on passive lumbar extension range of motion.

Physical Therapy; 67, 1987, no. 10, p. 1517-1521, 22 ref.

Nivel (C 3694)

The purpose of this study was to determine the effectiveness of prone spinal extension exercises for increasing passive lumbar extension range of motion in healthy young adults. Eighteen healthy female and 18 healthy male volunteers were divided randomly into control groups (women, n = 10; men, n = 8) and experimental groups (women, n = 8; men, n = 10). The experimental groups performed 20 repetitions of a prone extension exercise each day for four weeks; the control groups did not.

The researchers used spondylometry to measure lumbar extension ROM. The exercises produced a significant difference (p less than .025) in the passive lumbar extension ROM between the male experimental and control groups preventing a loss of spinal mobility in the men who exercised. Analysis of the data revealed no significant difference between the female groups. The results are discussed in the light of the clinical significance of lumbar extension ROM. We suggest further studies to examine the effects of lumbar extension exercises on patients with restricted ROM and low back pain.

TOLLISON, C.D., SATTERTHWAIT, J.R., KRIEGEL, M.L., HINNANT, D.W.

Interdisciplinary treatment of low back pain. A clinical outcome comparison of compensated versus noncompensated groups.

Orthopaedic Review; 19, 1990, no. 8, p. 701-706, 17 ref.

Nivel (C 3695)

Whether the compensation status of patients with chronic pain influences treatment outcome or not, remains an issue. This article describes the treatment outcome status of compensated versus non-compensated chronic low back pain patients who received comprehensive functional restoration treatment in a hospital-based, interdisciplinary, industrial medicine and pain management program. Results of this investigation revealed compensated versus noncompensated treatment group outcome differences in three of five outcome measures (increased physical activity levels, reduced pain intensity, and return to productivity) at discharge. The non-compensated group demonstrated a greater therapeutic response. These

group differences appear to have neutralized gradually, with no group outcome differences noted at the three-month follow-up.

TOLLISON, C.D., KRIEGEL, M.L.

Pain clinic #9. Physical exercise in the treatment of low back pain. Part I: A review.

Orthopaedic Review; 17, 1988, no. 7, p. 724-729, 40 ref.

Nivel (C 3696)

Physical exercise has been advocated as therapeutic in the treatment of low back pain as far back as 1937, when Williams proposed his now famous flexion exercises. Its current widespread use invites two questions: 1) what evidence is there to support this claim, and 2) which exercises have been proven beneficial? In this first paper of a three-part series, the literature is examined for answers to these questions. Subsequent articles will present practical clinical regimens of both stretching and strengthening exercises.

TOLLISON, C.D., KRIEGEL, M.L.

Pain clinic #10. Physical exercise in the treatment of low back pain. Part II: A practical regimen of stretching exercise.

Orthopaedic Review; 17, 1988, no. 9, p. 913, 917-923, 15 ref.

Nivel (C 3697)

In the first article of this three part series, research evidence for physical exercise in the treatment of low back pain were examined and data documenting significant therapeutic benefits was identified. However, different types and philosophies of exercise abound and, in clinical practice, little research evidence exists for substantiating one approach over another. This article outlines a practical physical stretching program with both empirical and research value in the treatment of over 4,100 patients with complaints of low back pain.

TOLLISON, C.D., KRIEGEL, M.L.

Pain clinic #11. Physical exercise in the treatment of low back pain. Part III: A practical regimen of strengthening exercise.

Orthopaedic Review; 17, 1988, no. 10, p. 1002-1006, 13 ref.

Nivel (C 3698)

The first and second articles in this three-part series reviewed the research evidence for physical exercise in the treatment of low back pain and outlined a specific and practical program of stretching exercise. In this final paper, the authors present and illustrate the remaining component of a physical exercise regimen utilized in the treatment of a large population of patients suffering either nonsurgical or postsurgical low back pain.

TOLLISON, C.D.

Physical exercise in the treatment of low back pain.

Orthopaedic Review; 17, 1988, p. 724-729

KNAW

TURNER, J.A., CLANCY, S., MCQUADE, K.J., CARDENAS, D.D.

Effectiveness of behavioral therapy for chronic low back pain: a component analysis.

Journal of Consulting and Clinical Psychology; 58, 1990, no. 5, p. 573-579, 36 ref.

Nivel (C 3699)

The effects of outpatient group behavioral therapy including aerobic exercise (BE), behavioral therapy only (B), and aerobic exercise only (E) on pain and physical and psychosocial disability were evaluated and compared in a group of mildly disabled chronic low-back-pain patients. Ninety-six patients were randomly assigned to the 3 treatments and a waiting-list control (WL) condition and assessed on a variety of patient self-report, spouse-rated, and direct observational measures at pretreatment, posttreatment, and 6- and 12-month follow-ups. Patients in the BE condition, but not the B or E conditions, improved significantly more pretreatment to posttreatment than did WL patients on the patient self-report and observer-rated measures. At both follow-ups, all 3 treatment groups remained significantly improved from pretreatment, with no significant differences among treatments.

WYNN-PARRY, C.B., GIRGIS, F.

The assessment and management of the failed back, Part II.

International Disability Studies; 10, 1988, no. 1, p. 25-28, 18 ref.

Nivel (C 3700)

Despite adequate surgery, a number of patients have a return of back pain and sciatica following operation, the so-called failed back. The results of a prospective study of 101 patients entering an intensive rehabilitation program for the failed back is described. The program consists of a team approach to the patient and his problems, using a variety of techniques to produce pain relief. Non-organic pain represents a significant problem in the failed back, 58% of the patients were completely or substantially relieved of their pain. Transcutaneous nerve stimulation was found to be the single most useful treatment with exercise second. It was found that non-organic pain could be relieved by this program.



### 3. Rheumatic Diseases and Back Pain in relation to Sports

ABEL, M.S.

Jogger's fracture and other stress fractures of the lumbo-sacral spine.

Skeletal Radiology; 13, 1985, no. 3, p. 221-227, 12 ref.

Nivel (C 3701)

The posterior rings of the lower lumbo-sacral vertebrae are subject to stress fractures at any part - pedicle, pars, or lamina. The site of fracture is apparently determined by the axis of weight bearing. The three illustrative clinical examples cited include a jogger with a laminar fracture, a ballet dancer with pedicle fractures, and a nine-year-old boy with fractures of pars and lamina. Chronic low back pain is the typical complaint with stress fractures of the lower lumbo-sacral spine. Special imaging techniques are usually needed to demonstrate these lesions, including vertebral arch views, multi-directional tomography, and computed tomography.

BOLAND, A.L., HOSEA, T.M.

Rowing and sculling and the older athlete.

Clinics in Sports Medicine; 10, 1991, no. 2, p. 245-256, 12 ref.

Nivel (C 3702)

Rowing is a strenuous sport that has a significant injury rate among competitive participants. Consequently, older individuals who are anticipating beginning recreational rowing should start with a thorough physical examination by their physician. Because the back and knees are the most frequently injured areas, an orthopedic assessment of these regions is indicated in those individuals who have had previous patellofemoral or low back pain. All prospective rowers should begin with a general conditioning program that addresses lower extremity and abdominal strengthening, flexibility, and aerobic conditioning. A thorough understanding of the proper mechanics of rowing is essential to avoid potential injury. Rowing is a satisfying sport that offers excellent physical exercise and cardiovascular benefits. Older individuals should be encouraged to row, but also should be aware of the variety of injuries this sport may produce.

BLOCK, J.E., FRIEDLANDER, A.L., BROOKS, G.A., STEIGER, P., STUBBS, H.A., GENANT., H.K.

Determinants of bone density among athletes engaged in weight-bearing and non-weight-bearing activity.

Journal of Applied Physiology; 67, 1989, no. 3, p. 1100-1105, 34 ref.

Nivel (C 3703)

To identify the factors associated with greater bone density among athletic individuals, three distinct groups of young male subjects were recruited. Twenty were nationally ranked water polo players, 19 were engaged in weight-training programs, and 20 subjects comprised a nonexercising comparison group. All participants had measurements of spinal trabecular and integral bone density by quantitative computed tomography as well as a determination of hip bone density by dual photon absorptiometry. A series of potential predictor variables included maximal O<sub>2</sub> uptake, back strength, leg strength, total kilocalories expended per day, body mass index, paraspinous muscle cross-sectional area, percent body fat, daily calcium intake, and age. No significant differences for any of the bone density measures between the two groups of athletic subjects was found, whereas bone density was generally significantly lower among the nonexercisers compared with either exercise group. Correlation analysis found only weak and somewhat inconsistent relationships when each of the subgroups was examined separately; however, when all subjects were assessed collectively, many more correlations reached significance. Paraspinous muscular area was found to be most robust in this regard, being significantly correlated with all three bone density measures ( $r = 0.33-0.55$ ). By using step-wise regression analysis in each subgroup, a consistent significant contribution ( $R^2 = 0.18-0.44$ ) of paraspinous muscle area to the variability in bone density at the spine and the hip, was found. When the data of all three subgroups were pooled, regression analysis reconfirmed the importance of the muscle parameter ( $R^2 = 0.06-0.27$ ) to bone density variation, but more importantly it showed that differentiation based on exercise status was most significant ( $R^2 = 0.18-0.22$ ).

BURRY, H.C.

Sport, exercise and arthritis.

British Journal of Rheumatology; 26, 1987, no. 5, p. 386-388, 24 ref.

Nivel (C 3704)

The relationship between sport, exercise and arthritis can be expressed as follows: 1. Distance running, even over long periods of time, is not associated with any excess incidence of osteoarthritis, but athletes experience a plethora of painful periarticular and musculo-tendinous complaints. 2. Sports which include repeated stress and strain, particularly angular and torsional, are associated with increased prevalence of enthesopathic lesions. 3. Such

sports, most particularly those which include collision and/or the possibility of uncontrolled movement, generate an excess of acute joint injuries such as meniscal and ligamentous disruption, conditions known to favour onset of osteo-arthritis. 4. It is possible that regular exercise may enhance the long term prospects of weight-bearing joints.

CHANTRAINE, A.

Knee joint in soccer players: osteoarthritis and axis deviation.

Medicine and Science in Sports and Exercise; 17, 1985, no. 4, p. 434-439, 11 ref.

Nivel (C 3705)

The knee joints of 81 veteran soccer players between ages 40 and 74 were examined. An analysis of and relationships between soccer practice at a top level, osteoarthritis, meniscectomy, and leg axes were evaluated. One-hundred and sixty-two knees were assessed through clinical examination and X-ray examination using a large table in order to observe the entire lower extremity's axis in weight bearing. First, it appears that radiological signs of osteoarthritis in soccer players increase with age in a much greater percentage than in a random population of the same age. Second, all players who have had a meniscectomy presented with radiological signs of osteoarthritis. In this series, 91 knees (56%) had X-ray signs of osteoarthritis. 64 knees (70%) in which the roentgenograms showed significant osteoarthritic changes were clinically asymptomatic. Third, the lower extremities displayed a varus angulation of both knees in 73% (meaning that 59 veteran players have a varus of both legs), while 81% of all the knees showed a varus deviation.

DORR, L.D.

Arthritis and athletics.

Clinics in Sports Medicine; 10, 1991, 2, p. 343-357

KNAW

The number of people participating in athletics does not equal the number of people with arthritis. There are no data to support the concern that athletic participation will make the onset of arthritic joints more likely. What is clear is that injuries that occur with athletics can increase the incidence of arthritis. If a patient does develop arthritis secondary to athletics, the treatment is not different than that offered for a spontaneously occurring arthritic joint. If an operation is necessary, the best operation depends a good deal on the goals of the patient. Continued athletic participation may be reasonable as long as the athletic activity is not vigorous and does not involve running and jumping or contact. The recommended athletic activities for patients with arthritis and for those having operations for arthritis are swimming, hiking, bicycling, walking, and

golfing. The operations recommended for arthritic patients under the age of 30 should be biologic operations such as fusion or osteotomy. In patients aged 30 to 45, the operation should be correlated to lifestyle and desired level of activity. A biologic operation is better for highly active patients. When patients reach the age of 45 or are older, total joint replacement usually is preferable because of the improved clinical functional results and the decreased stress on surrounding joints with arthroplasty. If patients are older than 60 years, total joint replacement is the operation of choice and usually will include a cemented prosthesis. Some surgeons at this time do prefer cementless total-joint replacement for all patients regardless of age. Patients who have arthritis can have a satisfying athletic and exercise routine if they simply apply common sense to the manner in which they conduct their activities.

GARBUTT, G., BOOCOCK, M.G., REILLY, T., TROUP, J.D.

Running speed and spinal shrinkage in runners with and without low back pain.

Medicine and Science in Sports and Exercise; 22, 1990, no. 6, p. 769-772, 20 ref.

Nivel (C 3706)

Decreases in stature (shrinkage) are used to indicate exercise induced spinal loading. This study examined the effect of three running speeds on two groups of runners, one with chronic low back pain. The two groups of seven male marathon runners ran at 70%, 85%, and 100% of their marathon race pace for 30 min on separate occasions. Before and after exercise the subjects were seated for 20 min with the lumbar spine supported. Stature was measured before pre-exercise sitting, before running, after 15 min of running, after 30 min of running, and after post-exercise sitting. A stadiometer accurate to within 0.5 mm was used to record changes in stature. Results showed no differences in response to the three running regimens between the groups ( $p$  greater than 0.05). Shrinkage was greater during the first 15 min, being 3.26 (+/- 2.78) mm compared with 2.12 (+/- 1.61) mm for the second 15 min of the run ( $p$  less than 0.05). The faster the running speed the greater the resultant shrinkage. The 70%, 85%, and 100% conditions caused 3.37 (+/- 2.38), 5.10 (+/- 1.90), and 7.69 (+/- 3.69) mm of shrinkage, respectively ( $p$  less than 0.005). These results suggest that low back pain is independent of the shrinkage induced by running. Further research is required to determine the effect of longer duration runs on spinal shrinkage.

GRAHAM, G.P., FAIRCLOUGH, J.A.

Early osteoarthritis in young sportsmen with severe anterolateral instability of the knee.

Injury; 19, 1988, no. 4, p. 247-248

KNAW

In a retrospective study of patients presenting with symptoms of knee instability, 16 patients were discovered who had developed severe chondromalacia or osteoarthritis of the femoral condyles. All of the patients gave a history of a previous severe knee injury occurring in their teenage years and all had continued to play competitive sport. Ten of the group had subsequent meniscal injuries requiring surgery. In nine of the group previous arthroscopic or open joint procedures had demonstrated normal femoral joint cartilage. There was no difference in the degree of degeneration in those who had had a meniscectomy as compared with those who had not had meniscal damage. It is concluded that severe anterolateral instability is a cause of early degenerative joint disease in young athletes even in the absence of meniscal damage and that they should be strongly advised against participating in active sport until the joint has been stabilized.

GRANHED, H., MORELLI, B.

Low back pain among retired wrestlers and heavyweight lifters.

American Journal of Sports Medicine; 16, 1988, no. 5, p. 530-533

KNAW

The lifetime incidence and prevalence of low back pain among 32 retired wrestlers (ages 39 to 62 years) and 13 retired heavyweight lifters (ages 40 to 61 years) were evaluated and compared to the corresponding results in a cross-sectional study of 716 men (ages 40 to 47 years). The radiologic findings and the findings upon physical examination in the athletes were compared to the findings in another study of normal, active, similarly aged men who were sampled at random. The lifetime incidence and prevalence of low back pain was higher among the wrestlers (59%) compared with both the lifters (23%) and the control group (31%). The tolerance for backache seemed to be higher among the athletes than the controls. A higher frequency of old fractures was found among the wrestlers. The athletes with fractures had a higher frequency of low back pain. A significant decrease in disk height was found among the lifters.

GREMION, G., CHANTRAINE, A.

Sport et arthrose

Schweizerische Zeitschrift für Sportmedizin; 38, 1990, no. 3, p. 143-149, 17 ref.

Nivel (C 3707)

Recent changes in lifestyle have considerably reduced the loads that joints have to bear through occupational stresses. It is now essentially during leisure time that most people use somewhat intensely their locomotive systems, mostly as sustained bouts of physical exercise. The physician is therefore led to examining critically these sports activities and their consequences. One has to be aware of the fact that some sports may bring about an articular overuse, partly through trauma and partly through microtrauma. Nevertheless, when reviewing recent literature on the implied relation between exercise and degenerative joint disease, one can observe many contradictories in the current opinions. This article intends to be both a review and a synthesis of the various factors which are commonly accepted as playing a role in the etiology of degenerative joint disease consecutive to exercise. The authors take into account by the same token the well-known advantages of physical activity such as prevention of cardiovascular disease and atherosclerosis, the enhancement of psychic well-being and the delaying of the onset of ageing. Thus, knowing which sports may promote degenerative joint disease under given conditions, the physician will be able to counsel people with an identified proneness to joint disease into undertaking more healthful physical workouts.

HARVEY, J., TANNER, S.

Low back pain in young athletes. A practical approach.

Sports Medicin; 12, 1991, no. 6, p. 394-406, 18 ref.

Nivel (C 3708)

Lumbar spine pain accounts for 5 to 8% of athletic injuries. Although back pain is not the most common injury, it is one of the most challenging for the sports physician to diagnose and treat. Factors predisposing the young athlete to back injury include the growth spurt, abrupt increases in training intensity or frequency, improper technique, unsuitable sports equipment, and leg-length inequality. Poor strength of the back extensor and abdominal musculature, and inflexibility of the lumbar spine, hamstrings and hip flexor muscles may contribute to chronic low back pain. Excessive lifting and twisting may produce sprains and strains, the most common cause of low back pain in adolescents. Blows to the spine may create contusions or fractures. Fractures in adolescents from severe trauma include compression fracture, comminuted fracture, fracture of the growth plate at the vertebral end plate, lumbar transverse process fracture, and a fracture of the spinous process. Athletes who participate in sports involving repeated and forceful hyperextension of the spine may suffer from lumbar facet syndrome, spondylolysis, or spondylolisthesis. The large sacroiliac joint is also prone to irritation. The signs and symptoms of disc herniation in adolescents may be more subtle than in adults. Disorders simulating athletic injury include tumours and inflamma-

tory connective tissue disease. Often, however, a specific diagnosis cannot be made in the young athlete with a low back injury due to the lack of pain localisation and the anatomic complexity of the lumbar spine. A thorough history and physical examination are usually more productive in determining a diagnosis and guiding treatment than imaging techniques. Diagnostic tests may be considered, though, for the adolescent athlete whose back pain is severe, was caused by acute trauma, or fails to improve with conservative therapy after several weeks. Radiographs, bone scanning, computed tomography, and magnetic resonance imaging may help identify, or exclude serious pathology. Fortunately, the majority of cases of low back pain in adolescents respond to conservative therapy. Immediate treatment of an acute injury, such as a sprain or strain, includes cryotherapy, electrogalvanic stimulation, anti-inflammatory medications and gentle exercises. Prolonged bed rest should be avoided since atrophy may occur rapidly. Strong analgesics are also usually contraindicated, except for sleep, since they mask pain and may allow overvigorous activity. Early strengthening exercises include the Williams flexion exercises and/or McKenzie extension exercises. Both exercise motions may often be prescribed. Athletes with an acute disc herniation, however, should only perform extension exercises initially. Athletes with spondylolysis, spondylolisthesis and facet joint irritation should initially be limited to flexion exercises. Brief sessions of walking, pool walking or jogging, and upright cycling may be started when tolerated to maintain aerobic conditioning. The proper timing for an athlete to return to activity depends on the demonstration of functional skills necessary to perform a specific sport. The final component includes a long term stretching, and back and abdominal strengthening programme.

ISDALE, A., HELLIWELL, P.S.

Athletes and osteoarthritis-is there any relationship?

British Journal of Rheumatology; 30, 1991, no. 1, p. 67-68, 12 ref.

Nivel (C 3709)

In this letter, the authors disagree with the conclusions drawn by the authors of a previous article<sup>1</sup> in which any direct relationship between osteoarthritis and strenuous exercise is assumed.

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<sup>1</sup> Hinnie et al.

Changes in keratin sulphate levels in the serum of a long distance runner.

British Journal of Rheumatology; 29, 1990, p. 314-315

KANNUS, P., JARVINEN, M.

Long-term prognosis of conservatively treated acute knee ligament injuries in competitive and spare time sportsmen.

International Journal of Sports Medicine; 8, 1987, no. 5, p. 348-351, 20 ref.  
Nivel (C 3710)

During the period 1975-1981, 221 persons were treated conservatively at Tampere University Central Hospital for an acute knee ligament injury. A total of 194 patients (88%) were reexamined 8 +/- 3 years after the injury. In the clinical and radiological results, there were no significant differences between competitive, spare time and non-sportsmen. However, the subjective and functional results were significantly better in competitive sportsmen than in the others. It was concluded that the amount of static knee instability and posttraumatic osteoarthritis depend much more on the seriousness of the primary ligament injury than on the muscle performance of the injured extremity, but by adequate thigh muscle rehabilitation the subjective and functional status of the injured knee can be significantly improved. Sports at the level of competitive activity seems to be an excellent means to achieve the best possible subjective and functional result after knee ligament injury.

KNOBLOCH, M., MARTI, B., BIEDERT, R., HOWALD, H.

Zur Arthrosegefährdung des oberen Sprunggelenkes bei Langstreckenläufern: Kontrollierte Nachuntersuchung ehemaliger Eliteathleten.

Sportverletzung Sportschaden; 4, 1990, no. 4, p. 175-179, 30 ref.  
Nivel (C 3711)

To study the potential influence of long-term, high-intensity physical training on premature osteoarthrosis of the ankle joint, the researchers re-examined former members of the Swiss National team from 1973 in retrospective cohort study in 1988. Twenty-seven track and field long-distance runners and orienteers (mean age 42 [95% confidence interval 41-43] years), 9 bobsledders (42 [39-46] years) and a control group of 23 healthy normal men (35 [33-36] years) were investigated. Physiological and exercise characteristics of all subjects had been recorded in 1973, and in 1988 these measurements were repeated together with a rheumatological and radiological examination of the ankle joint. A four-point scale of radiological joint state was used, taking into account the degree of subchondral sclerosis, osteophyte formation and joint space narrowing. In univariate analysis, the long-distance runners, and among them especially the orienteers (n = 10), showed significantly (both p less than 0.05) more radiological signs of degenerative ankle disease than controls. After adjustment for age, this difference disappeared. Age was itself significantly and positively related to radiological degenerative ankle disease (r less than 0.38; p less than 0.01). Orienteers reported significantly more frequently (60 vs 12%; p less



than 0.01) functional instability of the ankle joint than track and field runners. Functional and mechanical (clinical) instability were interrelated in our material ( $r = 0.33$ ;  $p$  less than 0.05) but neither of them was significantly related to radiological signs of degenerative ankle disease. The long-term, high-intensity distance running did not emerge as an independent risk factor for radiologically documented osteoarthritis of the ankle in this study.

LANE, N.E.; BLOCH, D.A.; WOOD, P.D.; FRIES, J.F.  
Aging, long-distance running, and the development of musculoskeletal disability. A controlled study.  
American Journal of Medicine; 82, 1987, no. 4, p. 772-780  
KNAW

Four hundred ninety-eight long-distance runners aged 50 to 72 years were compared with 365 community control subjects to examine associations of repetitive, long-term physical impact (running) with musculoskeletal disability and medical service utilization in a cross-section study. Runners had less physical disability than age-matched control subjects ( $p$  less than 0.01) and maintained more functional capacity ( $p$  less than 0.001) as measured by a modified Health Assessment Questionnaire Disability Index. Runners sought medical services less often, but one third of the visits that they did make were for running-related injuries. No differences were found between groups in conditions thought to predispose to osteoarthritis and musculoskeletal disability. Ligamentous laxity and family history of arthritis were similar in these two groups. Runners demonstrated better cardiovascular fitness and weighed less. Differences persisted after adjustment for age, occupation, and sex, and after inclusion or exclusion of subjects with major medical problems. Musculoskeletal disability appeared to develop with age at a lower rate in runners (0.003 units per year versus 0.028) than in community control subjects, and the decreased rate was observed with both lower extremity and upper extremity functions. These data suggest positive effects of systematic aerobic running activity upon functional aspects of musculoskeletal aging.

LANE, N.E., BLOCH, D.A., HUBERT, H.B., JONES, H., SIMPSON, U., FRIES, J.F.  
Running, osteoarthritis, and bone density: initial 2-year longitudinal study.  
American Journal of Medicine; 88, 1990, no. 5, p. 452-459, 22 ref.  
Nivel (C 3712)

The purpose of this study was to present the 2-year follow-up results examining associations of repetitive long-term physical impact (running) with osteoarthritis and osteoporosis in 34 members of a running club, now aged 52 to 74 years and 34 matched

control subjects. Roentgenograms of the hands, lateral lumbar spine, and knees were assessed in pairs (1984 and 1986) without knowledge of running status. Computerized scans of the first lumbar vertebrae were obtained to quantify bone mineral. Results: a decrease in bone density over the 2-year period was statistically significant for nearly all subjects, especially for runners who decreased their running habits. At the 2-year follow-up, runners maintained greater bone density. Progression of the roentgenographic scores for osteoarthritis demonstrated a statistically significant increase in almost all groups in this normative population over the 2-year period. Female runners had more spur formation in the weight-bearing knee roentgenograms than did control subjects. Conclusion: With the possible exception of spur formation in women, running did not appear to influence the development of radiologic osteoarthritis in the populations studied.

LANE, N.E., BLOCH, D.A., JONES, H.H., MARSHALL, W.H.J.R., WOOD, P.D., FRIES, J.F.

Long-distance running, bone density, and osteoarthritis.

JAMA; 255, 1986, no. 9, p. 1147-1151, 32 ref.

Nivel (C 3713)

Forty-one long-distance runners aged 50 to 72 years were compared with 41 matched community controls to examine associations of repetitive, long-term physical impact (running) with osteoarthritis and osteoporosis. Roentgenograms of hands, lateral lumbar spine, and knees were assessed without knowledge of running status. A computed tomographic scan of the first lumbar vertebra was performed to quantitate bone mineral content. Runners, both male and female, have approximately 40% more bone mineral than matched controls. Female runners, but not male runners, appear to have somewhat more sclerosis and spur formation in spine and weight-bearing knee x-ray films, but not in hand x-ray films. There were no differences between groups in joint space narrowing, crepitation, joint stability, or symptomatic osteoarthritis. Running is associated with increased bone mineral but not, in this cross-sectional study, with clinical osteoarthritis.

MARTI, B., KNOBLOCH, M., TSCHOPP, A., JUCKER, A., HOWALD, H.

Is excessive running predictive of degenerative hip disease? Controlled study of former elite athletes.

BMJ; 299, 1989, no. 6691, p. 91-93

Nivel (C 3714)

The objective of this study was to determine the effects of regular long distance running on the state of the hips in later life, by a retrospective study of a cohort of elite athletes and a group of normal, healthy, untrained controls examined 15 years after initial

testing. The subjects were 27 former long distance runners (mean age 42), nine former bobsleigh riders (mean age 42), and 23 normal, healthy, untrained men (mean age 35) who had been examined in 1973 and who agreed to re-examination in 1988. Physiological and exercise characteristics of all subjects had been recorded in 1973, and in 1988 these measurements were repeated together with radiological examination of the hips. An additive radiological index of hip disease based on grades of subchondral sclerosis, osteophyte formation, and joint space narrowing was significantly increased among runners as compared with bobsleigh riders and untrained controls. After adjustment for age the significant effect of type of sports activity remained ( $p = 0.032$ ). In multivariate analyses age and milage run in 1973 (97 km/week) emerged as independent, significant, and positive predictors of radiological signs of degenerative hip disease in 1988 ( $p = 0.017$  and  $p = 0.024$  respectively). Among runners alone running pace in 1973 rather than milage run was the stronger predictor of subsequent degenerative hip disease. The milage run in 1988 was not particularly predictive of the radiological index, but endurance in 1988 was inversely related to degenerative hip disease seen radiologically. Conclusion: long term, high intensity, high milage running should not be dismissed as a potential risk factor for premature osteoarthritis of the hip.

MARYMONT, J.V., LYNCH, M.A., HENNING, C.E.

Exercise-related stress reaction of the sacroiliac joint. An unusual cause of low back pain in athletes.

American Journal of Sports Medicin; 14, 1986, no. 4, p. 320-233

KNAW

Low back pain, secondary to a variety of musculoskeletal injuries, is common in individuals engaged in athletics. Sports-related stress reactions of the pars interarticularis are not uncommon. Stress reactions of the sacroiliac joint, on the other hand, are considered very rare. The limitations of plain radiographs and the ability of bone scintigraphy to detect stress lesions in athletes is well documented. In this paper the authors describe four young athletes with stress reactions of the sacroiliac region. They consider these to be uncommon but not rare, and probably self-limiting. Accurate diagnosis is important, however, to exclude more important causes of low back pain that require therapy. This type of injury also results in abnormal stresses to the lower extremities which can result in an independent and more serious injury. All sacroiliac stress reactions were unsuspected and were diagnosed only by bone scintigraphy after plain radiographs were noncontributory.

PANUSH, R.S., SCHMIDT, C., CALDWELL, J.R., EDWARDS, N.L., LONGLEY, S., YONKER, R., WEBSTER, E., NAUMAN, J., STORK, J., PETTERSSON, H.  
Is running associated with degenerative joint disease?  
JAMA; 255, 1986, no. 9, p. 1152-1154, 15 ref.  
Nivel (C 3715)

Little information is available regarding the long-term effects, if any, of running on the musculoskeletal system. The authors therefore compared the prevalence of degenerative joint disease among 17 male runners (mean age, 56 years; height, 180 cm [5 ft 11 in]; and weight, 73.02 kg [161 lb]) with 18 male nonrunners (mean age, 60 years; height, 178 cm [5 ft 10 in]; and weight, 78 kg [171 lb]). Running subjects (53% marathoners) ran a mean of 44.8 km (28 miles)/wk for 12 years. Pain and swelling of hips, knees, ankles, and feet and other musculoskeletal complaints among runners were comparable with those among nonrunners. Radiologic examinations (for osteophytes, cartilage thickness, and grade of degeneration) also were without notable differences among groups. No increased prevalence of osteoarthritis among the runners was found. According to the authors, the observations suggest, within the limits of their study, that long-duration, high-mileage running need not be associated with premature degenerative joint disease in the lower extremities.

PANUSH, R.S.

Does exercise cause arthritis? Long-term consequences of exercise on the musculoskeletal system.

Rheumatic Disease Clinics of North America; 16, 1990, no. 4, p. 827-836, 65 ref.

Nivel (C 3716)

Recreational exercise has achieved great popularity. Possible benefits to participants include increased longevity, decreased risk of cardiovascular disease, improved psychological well-being, and greater fitness. An important but yet unanswered concern is whether exercise or physical overuse conditions play a role in the pathogenesis of OA. In humans, anecdotal observations have suggested relationships between recreational activities and degenerative joint disease. The few controlled studies that exist, however, reported have indicated that exercise need not be deleterious to joints. Available data may be interpreted to suggest that reasonable recreational exercise-carried out within limits of comfort, putting joints through normal motions, and without underlying joint abnormality-need not inevitably lead to joint injury, even over many years. Finally, we are witnessing thoughtful re-evaluation of physical exercise as a therapeutic modality for arthritis patients. It is possible that certain patients may achieve psychological and clinical benefit from selected exercise programs.

PANUSH, R.S., BROWN, D.G.

Exercise and arthritis.

Sports Medicine; 4, 1987, no. 1, p. 54-64, 110 ref.

Nivel (C 3717)

Recreational exercise has achieved great popularity. Possible benefits to participants are increased longevity, decreased risk of cardiovascular disease, improved psychological well-being, and greater fitness. A very important but as yet unanswered concern is whether regular exercise will lead to degenerative joint disease or osteoarthritis. Many factors (e.g. physical characteristics of participants, biomechanical and physical features, nature of the playing surface and sport, manner of participation, preventive measures, and certain medical considerations) might influence the risk of developing osteoarthritis from sports participation. However, none of these have been evaluated. Although studies with animals have identified situations in which articular cartilage degeneration may be accelerated, experimental observations have not found normal joint motion in exercising animals to be harmful to joints. Anecdotal observations in man have suggested relationships between recreational activities and degenerative joint disease. However, those few controlled studies reported indicate that exercise need not be deleterious to joints. The investigators interpret the available data as suggesting that reasonable recreational exercise, carried out within limits of comfort, putting joints through normal motions, without underlying joint abnormality, even over many years, need not inevitably lead to joint injury.

PINTORE, E., MAFFULLI, N.

Osteochondritis dissecans of the lateral humeral condyle in a table tennis player. *Medicine and Science in Sports and Exercise*; 23, 1991, no. 8,

p. 889-891, 19 ref.

Nivel (C 3718)

The case of a table tennis player suffering from intra-articular loose bodies of the elbow is reported. The patient developed the first signs of osteochondritis dissecans of the right lateral humeral condyle at age 16 but underwent surgery only 6 yr later. He has now resumed training and competition, despite some residual stiffness due to early osteoarthritis. This is the first case of osteochondritis dissecans of the elbow ascribed to this sport. It was probably due to repetitive valgus compressive stresses at the radiocapitellar joint during the forced movements imposed by high-level table tennis in a young athlete.

PURANEN, J.

Running and primary osteoarthritis of the hip

BMJ; 2, 1975, no. 5968, p. 424-425, 5 ref.

Nivel (C 3719)

Study of the hip joints of 74 former runners to find the significance of physical strain in the development of osteoarthritis. Primary osteoarthritis was found in only 4% of the athletes, but in 8.7% of the controls. The conclusion can be made that competitive sports cannot be considered as a factor that would make osteoarthritis more likely.

ROSSI, F., DRAGONI, S.

Lumbar spondylolysis: occurrence in competitive athletes. Updated achievements in a series of 390 cases.

Journal of Sports Medicine and Physical Fitness; 30, 1990, no. 4, p. 450-452

KNAW

On the basis of 390 cases of lumbar spondylolysis found in 3132 competitive athletes, the authors introduce some judgements on the incidence of this illness in individual sports. The numerical analysis permits the authors to affirm that the incidence of this illness in competitive athletes is higher than the percentage reported in literature concerning the non-sports population. This statement assumes more relevance if one keeps in mind the high percentage of spondylolysis which has been observed in some sports disciplines such as diving (43.13%), wrestling (29.82%) and weight lifting (22.68%).

SCHEIB, J.S.

Diagnosis and rehabilitation of the shoulder impingement syndrome in the overhand and throwing athlete.

Rheumatic Disease Clinics of North America; 16, 1990, no. 4, p. 971-988, 31 ref.

Nivel (C 3720)

The shoulder apparatus is of elegant structural design, affording great range of movement with substantial power in many planes of movement. The underlying anatomic relationships that allow great mobility that also render the shoulder susceptible to injury. Injury in repetitive overhand activities usually occurs in the form of impingement, which may result from many factors, including multidirectional instability, anterior subluxation, and imbalanced force couple mechanisms, among others. Diagnosis requires a thorough history and physical examination. The impingement sign and test are among the most useful diagnostic maneuvers available. Rehabilitation is individualized, depending upon the cause of impingement, severity of injury, and response to therapy. Overuse syndromes

mandate rest and control of inflammation through the use of ice, NSAIDs, and local injections of steroids followed by passive, active-assist, and active ROM, stretching and mobilization exercises. As pain and inflammation subside, isometric or isotonic exercises are prescribed initially to strengthen the rotator cuff musculature and, therefore, the caudal glide mechanism. Subsequent strengthening exercises are then performed in other planes of movement to strengthen the remaining shoulder-complex muscles. The patient is then advanced to isokinetic training. Stretching is emphasized as an essential preparatory activity for all types of exercise. Maintaining contralateral and lower-limb strength, and cardiovascular conditioning is necessary if athletic activities are to be resumed at the previous level of performance. Following return to athletic performance, an analysis of training habits should be made and a prescription for exercise issued, based on the avoidance of aggravating factors and cultivation of activities that enhance existing static and dynamic shoulder stabilizers. Any return of symptoms should prompt an immediate reappraisal with the proper intervention, including adjustment of activity level and exercises as deemed appropriate. With proper conservative therapy, relatively few athletes should require surgical treatment.

SNYDER-MACKLER, L.

Rehabilitation of the athlete with low back dysfunction.

Clinics in Sports Medicine; 8, 1989, no. 4, p. 717-729, 31 ref.

Nivel (C 3721)

Low back injuries in athletes can be classified into three diagnostic categories: disk problems, hypomobility/hypermobility problems, and muscular problems. Various strategies have been presented for the identification and treatment of these disorders. The translation of rehabilitation procedures to an athletic population including resumption of training and competition have been discussed.

SPRING, H.

Sport bei Spondylitis ankylosans.

Schweizerische Rundschau für Medizin Praxis; 80, 1991, no. 23, p. 629-635

KNAW

As a therapy of ankylosing spondylarthritis still remains empirical, gymnastics and sports are of particular importance within the treatment of this disease. They aim at the improvement or at least the preservation of mobility, force and endurance. By those means an eventual immobilisation of the axial skeleton or the peripheral joints should take place in a position as favourable to function as possible. Various joint mobilisation techniques as well as muscle stretching are used to improve mobility. The latter thus pointedly prevents muscular disbalances. Various training methods are able

to improve muscular performance. Slow dynamic force training can be used in gymnastic lessons as well as in home programmes. Maximal and staying power can thus be increased. Aerobic muscular training favours general efficiency, has a positive influence on risk factors of cardiac and vascular diseases and improves thoracic excursion. Motivation of the patient is correlated with the diversion of exercise, therapies and sporting activities. The suitability of these measures are to be judged by expected maximal strain, the control of motion pattern, the effect of external forces as well as by the hazard to fall. Each and every sport activity has to be accompanied by supportive gymnastics. The most important disciplines are evaluated.

WATKINS, R.G., DILLIN W.H.  
Lumbar spine injury in the athlete.  
Clinics in Sports Medicine; 9, 1990, no. 2, p. 419-448  
KNAW

To summary, the keys to proper management of lumbar spine problems in athletes include (1) comprehensive diagnosis; (2) aggressive, effective nonoperative care; and (3) pinpointing operations that do as little damage as possible to normal tissue but correct the pathologic lesion.

WETZ, H.H., SCHUCHARDT, E.  
Instabilitätsprobleme der Wirbelsäule im Sport  
Sportverletzung Sportschaden; 4, 1990, no. 4, p. 186-192, 21 ref.  
Nivel (C 3722)

In modern competitive sports the vertebral column is increasingly subjected to maximum stress. This has led to lasting damage especially in young competitive sportsmen in whom the vertebral column had not yet developed to full maturity. Back pain can be more successfully analysed in respect of its causes by means of the additional use of the knowledge and examination methods of manual medicine. Emphasis is placed in this article on the importance of such pain as an early symptom of ligamentous instability. Therapeutic recommendations are given.



#### 4. Miscellaneous

ACHTERBERG, J., MCGRAW, P., LAWLIS, F.

Rheumatoid Arthritis: a study of relaxation and temperature biofeedback training as an adjunctive therapy.

Biofeedback and Self-Regulation; 6, 1981, no. 2, p. 207-223, 17 ref.

Nivel (C 3723)

Rheumatoid Arthritis (RA) is a painful systemic disease and is believed to be exacerbated by stress. Relaxation and biofeedback strategies have demonstrated utility in alleviating both pain and stress-related symptomatology, and therefore were tested for efficacy with this disease in a two phase study. First, 24 patients were taught a relaxation technique and then trained in either temperature elevation or reduction. Second, a group of 15 patients thus trained was compared with 8 others who received traditional physiotherapy modalities.

BAR-OR, O.

Pathophysiological factors which limit the exercise capacity of the sick child.

Medicine and Science in Sports Exercise; 18, 1986, no. 3, p. 276-282, 74 ref.

Nivel (C 3724)

While deficient exercise performance of sick children results from hypoactivity and detraining, it can also be caused by specific pathophysiological factors. These can affect one or more components of physical fitness. Low maximal aerobic power will result from a low maximal stroke volume, as in aortic stenosis or cardiomyopathy; a low maximal heart rate, as in congenital complete heart block or intake of beta-blockers; a low  $O_2$  content of the arterial blood, as in anemia or advanced cystic fibrosis; and a high  $O_2$  content of mixed-venous blood, as in muscle atrophy or severe malnutrition. A high  $O_2$  cost of locomotion, as in advanced obesity or cerebral palsy, will cause the patient to exert at a high percentage of his maximal aerobic power and thus fatigue easily. A subnormal muscle strength, as in progressive muscular dystrophy or juvenile rheumatoid arthritis, is sometimes the primary factor that limits the walking ability or other daily functions. Recent data suggest that local muscle endurance, as assessed by the Wingate anaerobic test, is particularly deficient in some neuromuscular diseases. Examples are muscular dystrophies and spastic cerebral palsy. The ratio of peak anaerobic power to peak aerobic power seems lower in such patients than in able-bodied controls.

BENNETT, R.M., CLARK, S.R., GOLDBERG, L., NELSON, D., BONAFEDE, R.P., PORTER, J., SPECHT, D.

Aerobic fitness in patients with fibrositis. A controlled study of respiratory gas exchange and 133-xenon clearance from exercising muscle.

Arthritis and Rheumatism; 32, 1989, no. 4, p. 454-460, 26 ref.

Nivel (C 3725)

Aerobic fitness was evaluated in 25 women with fibrositis, by having them exercise to volitional exhaustion on an electronically braked cycle ergometer. Compared with published standards, more than 80% of the fibrositis patients were not physically fit, as assessed by maximal oxygen uptake. Compared with matched sedentary controls, fibrositis patients accurately perceived their level of exertion in relation to oxygen consumption and attained a similar level of lactic acidosis, as assessed by their respiratory quotient and ventilatory threshold. Exercising muscle blood flow was estimated by 133-xenon clearance in a subgroup of 16 fibrositis patients and compared with that in 16 matched sedentary controls. The fibrositis patients exhibited reduced 133-xenon clearance. These results indicate a need to include aerobic fitness as a matched variable in future controlled studies of fibrositis and suggest that the 'detraining phenomenon' may be of relevance to the etiopathogenesis of the disease.

BENTLEY, G.

Anterior knee pain: diagnosis and management.

Journal of the Royal College of Surgeons of Edinburgh; 34, 1989, supplement 6, p. 2-3

KNAW

Anterior knee pain is caused by a number of distinct conditions which can only be diagnosed accurately by arthroscopy. Chondromalacia patellae is an important cause of disability in young people which rarely progresses to osteoarthritis. Treatment is by non-operative quadriceps strengthening exercises or by conservative surgery combined with careful supervised rehabilitation.

BEGEL, R.R.

Disabling effects of inactivity and importance of physical conditioning.

A historical perspective.

Rheumatic Disease Clinics of North America; 16, 1990, no. 4, p. 791-801, 29 ref.

Nivel (C 3726)

This article examines the effects of inactivity or absence of activities that are strenuous. What is the effect of inactivity that is enforced for a period of time by disease? What modifications of function occur because of this restriction of activity separately from

disease?

BLOCK, J.E., SMITH, R., FRIEDLANDER, A., GENANT, H.K.

Preventing osteoporosis with exercise: a review with emphasis on methodology.

Medical Hypotheses; 30, 1989, no. 1, p. 9-19

RUG

Exercise is thought to have considerable potential as a preventive for osteoporosis. In this study the investigators examined 27 studies that address the prophylactic role of exercise in osteoporosis. The results from both cross-sectional and longitudinal studies showed that differences in bone mass were more pronounced in the axial skeleton (as opposed to) the peripheral compact skeleton. The 17 cross-sectional studies demonstrated greater bone mass among highly trained athletes compared with sedentary subjects, while results among recreational athletes were inconsistent. The 10 prospective investigations examining the effect of exercise on bone mass yielded conflicting results; only one study of six found an overall positive response in compact bone mass at the radial site, and only one study examining the spine showed a significant gain among the exercisers. Additionally, all the prospective investigations included serious methodologic flaws; most failed to employ a randomized design, appropriate estimates of sample size were lacking, none provided information on blind outcome assessment, and most studies were of short duration. Current evidence suggests that exercise may have only limited value in affecting bone mass in the short term and widespread recommendations for the prophylactic use of exercise should await further validation using greater methodological rigor.

BREWER, V., MEYER, B.M., KEELE, M.S., UPTON, S.J., HAGAN, R.D.

Role of exercise in prevention of involutional bone loss.

Medicine and Science in Sports and Exercise; 15, 1983, no. 6, p. 445-449, 22 ref.

Nivel (C 3727)

Physical inactivity has been cited as a possible cause of osteoporosis. Because involutional bone loss in the female can begin as early as the age of 40, the purpose of this investigation was to compare the skeletal status of two groups of premenopausal middle aged women of diverse physical activity levels. Bone mineralization was determined in 42 marathon runners and 38 sedentary females. Following normalization of the data for differences in age and body size, regression analysis suggests that the runners maintain their bone mass longer at the distal radius, a site frequently fractured in women after midlife.

EKBLOM, B., GOLDBARG, A.N.

The influence of physical training and other factors on the subjective rating of perceived exertion.

Acta Physiologica Scandinavica; 83, 1971, p. 399-406, 12 ref.

Nivel (C 3728)

The relationship between the subjective rating of perceived exertion (RPE) and different physiological variables during work were investigated in 19 healthy subjects under the following conditions: 1. after heart rate (HR) had been experimentally changed during work by the use of autonomic nervous system blocking agents, 2. during different types of physical work and 3. before and after an 8 week period of physical training, respectively.

HR mirrors the physical strain (subjectively) experienced by the subject. However, this good correlation between HR and RPE was altered during the experiments with blocking agents. Therefore, a tachycardia as such is not the primary factor in the setting of HR during exercise - RPE was higher for a given level of oxygen uptake during arm work than during leg work, as well as during bicycling compared to running or swimming. A better correlation was found in these experiments between RPE and blood lactate concentration. After training, and in parallel to the decrease in HR at submaximal work loads, RPE was lower for a given level of oxygen uptake, but was the same when related to the relative (per cent of maximum) oxygen uptake.

GERBERICH, S.G., ERICKSON, D., SERFASS, R., BEARD, B., POULSON, E., ROSS, S., WASSER-SCOTT, P., DAUWALTER, T., OLSON, C., LEWIS, S.

Quadriceps strength training using two forms of bilateral exercise.

Archives of Physical Medicine and Rehabilitation; 70, 1989, p. 775-779, 27 ref.

Nivel (C 3729)

The purpose of this study was to determine the effectiveness of quadriceps strength training in 15 women using bilateral constant resistance computerized exercise equipment that enabled only concentric contractions. To facilitate this investigation, data from an experimental control group (n=14) using bilateral variable resistance exercise equipment which enables both concentric and eccentric muscle contractions, and a nonexercise control group (n=17) were incorporated into the study design. Compared with the nonexercise group, there were significant increases in strength in the experimental exercise groups. Yet, these increases were significant in both groups only on the right legs. In addition, the development of transient knee pain in two subjects engaged in both concentric and eccentric exercise training required their removal from this study.

KILBOM, A.S.A.

Physical training with submaximal intensities in women: reaction to exercise and orthostasis.

Scandinavian Journal of Clinical and Laboratory Investigation; 28, 1971, p. 141-161, 44 ref.

Nivel (C 3730)

33 women in different age groups participated for about 7 weeks in a physical training programme. Training was conducted intermittently 2-3 times a week on a bicycle ergometer. The workload corresponded to 70% of the maximal aerobic power. Heart rate at a given submaximal work load decreased by 10-15 beats/min. Maximal aerobic power increased by about 11%. Blood pressure at a given submaximal load was lower after training, but in relation to relative work load, i.e. heart rate, it was unchanged. Heart rate was lower during orthostatic tests after training in the younger subjects and blood pressure was somewhat lower.

KRAAG, G., STOKES, B., GROH, J., HELEWA, A., GOLDSMITH, C.

The effects of comprehensive home physiotherapy and supervision on patients with ankylosing spondylitis - a randomized controlled trial.

Journal of Rheumatology; 17, 1990, no. 2, p. 228-233, 14 ref.

Nivel (C 3731)

Fifty-three patients with ankylosing spondylitis (AS) were randomly allocated whereas 26 experimental patients received both physiotherapy and disease education, 27 control patients received neither. The primary treatment outcome was a change in spinal mobility measured at 4 months by the fingertip-to-floor distance. Experimental patients had more improvement in the fingertip-to-floor distance ( $p < 0.004$ ) and in function ( $p < 0.001$ ) than control patients. Physiotherapy with disease education seems effective in the treatment of patients with AS.

MATTSSON, E., OLSSON, E., BROSTROM, L.A.

Assessment of walking before and after unicompartmental knee arthroplasty.

A comparison of different methods.

Scandinavian Journal of Rehabilitation Medicine; 22, 1990, no. 1, p. 45-50, 20 ref.

Nivel (C 3732)

Walking ability was assessed in twenty patients before and one year after knee replacement with a cemented unicompartmental, Brigham prosthesis (mean age 63.4 years, nine women). All patients had moderate medial gonarthrosis. One year after surgery, knee function, assessed by the BOA score, self-selected and maximal walking speed as well as single limb support of the involved leg were increased. Pain and exertion during walking and oxygen cost

of level walking were decreased at all measured speeds. Individual improvement in self-selected walking speed was correlated to improvement in maximal walking speed. Individual decrease of oxygen cost of level walking was correlated to decrease of perceived pain and exertion during walking. For clinical routine purpose clinical assessment, especially of pain, supplemented with measurement of self-selected walking speed were found to be sufficient for assessing effects of treatment such as unicompartmental prosthetic knee replacement.

MCCAIN, G.A., BELL, D.A., MAI, F.M., HALLIDAY, P.D.

A controlled study of the effects of a supervised cardiovascular fitness training program on the manifestations of primary fibromyalgia.

Arthritis and Rheumatism; 31, 1988, no. 9, p. 1135-1141, 25 ref.

Nivel (C 3733)

Forty-two patients with primary fibromyalgia were randomized into a 20-week program consisting of either cardiovascular fitness (CVR) training or simple flexibility exercises (FLEX) that did not lead to enhanced cardiovascular fitness. Patients were supervised by the same medical fitness instructors. Patients in neither group had contact with members of the other group, and were blinded as to the exercise taught to the alternative group. Groups met for 60 minutes 3 times each week. The compliance rate was 90%. Thirty-eight patients completed the study (18 with CVR training and 20 with FLEX). Blind assessments (standardized in preliminary trials to achieve acceptable inter-rater agreement) were performed by the same 2 examiners. After 20 weeks, patients receiving CVR training showed significantly improved cardiovascular fitness scores compared with those receiving FLEX training ( $t[35] = -4.22$ ,  $p$  less than 0.003). Logistic regression analysis showed clinically and statistically significant improvements in pain threshold scores, which were measured directly over fibrositic tender points, in patients undergoing CVR ( $t[35] = 2.21$ ,  $p$  less than 0.04). There was also a trend toward improvement in pain scores (visual analog scale) in the CVR group, but this did not reach statistical significance. There was no improvement in the percentage of body area affected by fibrositic symptoms or the number of nights a week or hours a night of disturbed sleep (self-report inventories). However, compared with the FLEX group, the CVR-trained patients improved significantly in both patient and physician global assessment scores. Because multidimensional symptom self-report inventory scores were similar in CVR-trained and FLEX-trained groups before and after exercise, improvements in the CVR-trained group were not the result of a reduction in psychological distress.

MENGSHOEL, A.M., FORRE, O., KOMNAES, H.B.

Muscle strength and aerobic capacity in primary fibromyalgia.

Clinical and Experimental Rheumatology; 8, 1990, no. 5, p. 475-479, 30 ref.  
Nivel (C 3734)

Twenty-six women with primary fibromyalgia were tested for muscle strength and for aerobic capacity and fatigue. Grip strength was measured with a manometer. In the patient group the grip strength was  $58 \pm 22$  kPa (mean  $\pm$  SD) versus  $97 \pm 17$  kPa in healthy matched controls ( $p$  less than 0.01). The patients performed a mean of  $10 \pm 6$  repetitions with maximal grip pressure (dynamic endurance work), while the controls performed  $13 \pm 6$  repetitions ( $p$  less than 0.01). The upper extremity was kept in a fixed position for  $152 \pm 147$  seconds in the patient group versus  $413 \pm 244$  seconds in the control group (static endurance work),  $p$  less than 0.004. Normal aerobic capacity ( $O_2$  ml/kg min) was found in the patient group. Expected fatigue values were determined by Borg's rating scale for perceived exertion according to the heart rate in a cycle ergometer test. There was a significantly higher mean fatigue score in the patient group as compared to the expected values ( $p$  less than 0.0001).

MOREY, M.C., COWPER, P.A., FEUSSNER, J.R., DIPASQUALE, R.C.,  
CROWLEY, G.M., KITZMAN, D.W., SULLIVAN, R.J.

Evaluation of a supervised exercise program in a geriatric population.

Journal of the American Geriatrics Society; 37, 1989, no. 4, p. 348-354,  
30 ref.

Nivel (C 3735)

Most studies that assess the effects of exercise in the elderly involve subjects who are in good health. The objective of this prospective longitudinal study was to examine the impact of exercise on cardiovascular fitness, flexibility, and strength in an elderly population that included chronically ill individuals. Patients were recruited initially from a population of veterans over 64 years of age who use a VA outpatient clinic as their regular source of care. The exercise intervention consisted of 90 minutes of exercise 3 days a week at 70% of the patient's maximal capacity. Activities included stationary cycling, stretching, weight training, and walking. Of 69 patients who began the program, 49 (71%) reached 4-month follow-up. Most patients completing follow-up (76%) had at least one chronic disease, such as arthritis, hypertension, or heart disease. Patients who dropped out were more likely to have multiple chronic illnesses than those who remained in the program. Average weekly attendance was 65% and was stable over time. Improvements in cardiovascular fitness at 4-month follow-up were significant: Metabolic equivalents increased from  $7.1 \pm 2.3$  to  $8.3 \pm 2.6$  ( $p$  less than .001), treadmill time increased from  $8.5 \pm 3.8$  to  $11.2 \pm 4.2$  minutes ( $p$  less than .001), submaximal heart

rate decreased from 123.7 +/- 18.8 to 118.8 +/- 19.4 beats per minute (p less than .001) and resting heart rate decreased from 68.1 +/- 10.6 to 63.3 +/- 11.6 beats per minute (p = .005). Hip flexibility also increased significantly from 58.8 +/- 13.8 to 67.7 +/- 9.9 degrees (p < .001), and abdominal strength increased significantly from 88.8 +/- 32.4 to 104 +/- 28.4 foot pounds (p < .001). No major complications resulted from exercise.

NICKEL, V.L., KRISTY, J., MCDANIEL, L.V.

Studies on joint temperature, joint stiffness and muscle weakness in rheumatoid arthritis: an experimental and clinical investigation.

Acta Rheumatologica Scandinavica, Supplement 14; 1969, p. 70-98  
Nivel (C 3736)

This investigation is a study of what information can be obtained about the clinical course of disease in patients with rheumatoid arthritis using some recently developed methods of evaluation. The interest has been focussed on three common disease manifestations, viz., joint heat, joint stiffness and muscle weakness, all of which constitute parameters often used in evaluating schemes. The main problem in this investigation has not been to develop methods that can be used in anti-rheumatic drug trials. Instead, it was important to investigate the relation existing between the disease manifestations studied and to draw some general conclusions about their interaction within the rheumatic patient. Three methods have been applied, two objective and one semi-objective, viz., infrared thermography, visco-elastic joint stiffness registration in MP joints and maximal voluntary isometric muscle strength determinations.

RASMUSSEN, J.O., HANSEN, T.M.

Physical training for patients with ankylosing spondylitis.

Arthritis Care and Research; 2, 1989, no. 1, p. 25-27, 10 ref.

KNAW

The purpose of this article is to report the training program and preliminary results achieved at the King Christian X's Hospital for Rheumatic Diseases, which serves a Danish county of 250,000 inhabitants. Since 1982, all patients suffering from Ankylosing Spondylitis (AS) have been offered a training program in addition to general information about the disease, instruction in terms of exercises, and ergonomical guidance. The results so far seem to indicate that regular physical training of patients suffering from AS may exert a stabilizing effect, preserving mobility and preventing further deterioration.



RUDD, E.

Preventive aspects of mobility and functional disability.

Scandinavian Journal of Rheumatology, Supplement; 82, 1989, p. 25-32,  
14 ref.

Nivel (C 3737)

Among bone and joint diseases, frequent causes of disability include (a) fractures from falls and osteoporosis, (b) osteoarthritis of hips, knees, and lumbar spine, (c) painful feet, (d) back pain, and (e) intractable rheumatoid arthritis. Risk factors for falling may arise from factors intrinsic to the patient and from hazards in the environment. The prevention and management of osteoporosis are controversial. Most experts endorse the use of oestrogens in postmenopausal women and the need for continuing physical activity, particularly walking, in both elderly men and women. To preserve independent living, conservative management of osteoarthritis of hip, knee, and low back consists of properly balancing rest, non-weight-bearing exercises, and the use of walking aids. In rheumatoid arthritis, the clinician should emphasize (a) exercises to maintain range of motion and (b) muscle strength, both to prevent flexion contractures and to maintain the ability to carry on activities of daily living.

SCHAPIRA, D.

Physical exercise in the prevention and treatment of osteoporosis: a review.

Journal of the Royal Society of Medicine; 81, 1988, no. 8, p. 461-463, 51 ref.

Nivel (C 3738)

In this review the author concludes that physical exercise seems to have a beneficial influence on the growing skeleton by helping to maximize the adult body mass. Even the old bone responds to mechanical stress and involutional osteoporosis might be partially reversed by physical training. As the bone mass appears to be increased specifically in areas exposed to skeletal forces, physical activity must be directed to the main zones prone to fracture (the spine, the hip and the wrist) in order to minimize and even to prevent their occurrence. Improvement of the general physical performance, the well being and the social effect are additional desirable effects of continuous physical activity.

WOLFE, L.A., HALL, P., WEBB, K.A., GOODMAN, L., MONGA, M.,  
MCGRATH, M.J.

Prescription of aerobic exercise during pregnancy.

Sports Medicine; 8, 1989, no.5, p. 273-301, 137 ref.

Nivel (C 3739)

Available evidence supports the existence of both risks and benefits of aerobic conditioning during human pregnancy. During intensive

exertion, maternal skeletal muscle and the fetus may compete for blood flow, oxygen delivery and essential fuel substrates. Hence, the most important hypothetical risks include acute fetal hypoxia, hyperthermia and malnutrition. If exercise is repeated on a chronic basis, teratogenic effects, fetal growth retardation or altered fetal development may result if maternal/fetal adaptive reserve is exceeded. A dose-response relationship for such effects has been demonstrated in laboratory animals, but specific findings may have limited applicability to voluntary exercise in pregnant women. Although further investigation is needed, the majority of published studies suggest that fitness-type conditioning does not jeopardise fetal well-being in healthy well-nourished women. Benefits of such exercise appear to include increases in maximal aerobic power ( $VO_{2max}$ , L/min) and enhanced cardiopulmonary reserve. It has also been proposed that exercise prevents accumulation of excessive body fat, promotes psychological well-being, helps to prevent gestational diabetes and low back pain and may facilitate labour. However, these benefits remain to be confirmed by objective scientific study. Due primarily to a lack of scientific data, existing medical guidelines for exercise during pregnancy are conservative and follow a common sense approach. Good agreement exists on the need for preparticipation medical screening and continuing surveillance to verify the existence of maternal/fetal adaptive reserve. Women are advised to select safe, non-ballistic exercise modalities and to avoid thermal or hyperbaric environmental stress during exercise. Exercise in the supine position is also prudent to avoid, particularly in late gestation. The usefulness of heart rate in prescribing and monitoring exercise intensity has been questioned, with use of conventional perception of exertion scales being the most logical alternative. Prediction of maximal aerobic power ( $VO_{2max}$ ) from submaximal work rate/heart rate relationships is also problematic during pregnancy. Other areas of debate include the advisability of initiating a new exercise program during pregnancy, methods for prevention of fetal hyperthermia, the safety of weight-training/isometric exercise and optimal methods for the training of pre/postnatal fitness instructors.

SCHOUTENS, A., LAURENT, E., POORTMANS, J.R.

Effects of inactivity and exercise on bone.

Sports Medicine; 7, 1989, no. 2, p. 71-81, 54 ref.

Nivel (C 3740)

Bone mass and muscular mass show a parallel evolution during growth, and parallel involution with age. However, the bone loss related to the withdrawal of oestrogens is independent of muscular waste. The extensive study of disuse osteoporosis shows that exercise without weightbearing cannot counteract the loss of bone mass provoked by bed rest or weightlessness. Physical training, even at low frequency (30 to 60 min/day, 2 or 3 days/week), can

increase bone mass or reduce bone loss associated with age. This effect is even present when exercise is practised by very old people at a seemingly low level of muscular tension on bone. It is not known whether muscular exercise could be helpful in pathological osteopenia. Experiments in animals indicate a short-lived benefit of exercise practised during a definite growth period; the long term effect of physical training in humans, after cessation of such activity, has not been studied extensively. Equal distribution of tension on all parts of the skeleton is probably not mandatory to obtain a general effect of exercise on bone mass. It is assumed that muscular exercise acts through tension exerted on bone, but the exact mechanism is unknown, as are the specifications of effective exercise in terms of site of application, intensity, frequency and duration. Moreover, little is known about the expected synergy between exercise and occupational activity.

SMITH, E.L., RAAB, D.M.

Osteoporosis and physical activity.

Acta Medica Scandinavica Supplement; 1986, 711, p. 149-156

KNAW

Bone involution poses serious health risks for aging women. Bone mass is subject to both local (mechanical) and systemic (hormonal) homeostatic control mechanisms. The local forces acting on bone are due to gravity and muscular contraction. There are several theories concerning the mechanisms of local control. When bent, bone functions as a piezoelectric crystal with calcium accumulation on the negatively charged concave surface. Microfractures that occur in response to stress greater than normal levels stimulate osteoclastic activity to remove the damaged structure. Studies of astronauts and immobilized subjects have consistently found bone atrophy. The degree of bone loss is related to the difference in levels of stress normally applied and those at bedrest in the site studied. Correspondingly, athletes have greater bone mass than the sedentary population, with the greatest hypertrophy found in the areas most stressed. Exercise intervention also promotes bone hypertrophy. Both middle-aged and elderly women increase bone mass or reduce the rate of loss in response to physical activity intervention programs.

THOMPSON, W.G., NAMEY, T.C.

Cardiovascular complications of inactivity.

Rheumatic Disease Clinics of North America; 16, 1990, no. 4, p. 803-813, 87 ref. Nival (C 3741)

Inactivity has a number of consequences for the cardiovascular system. In particular, inactivity can lead to obesity, which can aggravate arthritis. An examination of the effect of exercise on the

cardiovascular system requires the review of epidemiologic or population-based studies, because there are no large randomized trials with an exercise control group. Small randomized trials looking at exercise and the individual risk factors are reviewed.

VINGARD, E.

Overweight predisposes to coxarthrosis. Body-mass index studied in 239 males with hip arthroplasty.

Acta Orthopaedica Scandinavica; 62, 1991, no. 2, p. 106-109, 17 ref.  
Nivel (C 3742)

In a case-control study, the body-mass index (BMI) at age 20, 30, 40, and 50 was studied in 239 men who had just received a hip prosthesis because of coxarthrosis, and in 302 controls, randomly selected from the general population. Information about weight, occupational physical load, sports activities, smoking, and many other factors was self-reported in a questionnaire. Men with a BMI greater than the mean BMI + 1 SD had an increased relative risk of developing severe coxarthrosis as compared with men with a BMI less than the mean BMI -1 SD. Those who were slightly obese at the age of 40 years had a relative risk of 2.5 for later surgery of the hip.

ZIELKE, A.

Physiotherapie bei degenerativen Gelenkerkrankungen.

Z-Gesamte-Inn-Med. 1987 Feb 15; 42(4): 105-8, 22 ref.  
Nivel (C 3743)

By virtue of their wide spreading and their effects on the social working ability, degenerative joint diseases increasingly gain significance. In the concept of therapy of this group of diseases, apart from pharmacotherapy and operative treatment, physiotherapy plays an important role. After having proved that kinetotherapy is a form of treatment which is to be prescribed in the first place, the passive therapeutic methods such as thermotherapy (heat and cold), application of ultrasound, electro-therapeutic procedures, massages promising success in arthrosis are described and questions of dosage are discussed. At the same time the significance of a health resort therapy for this group of diseases is discussed. After a randomized analysis which includes 1,893 patients with arthrosis, the ratio of active to passive forms of therapy during a course of treatment in the state health resorts Bad Brambach-Bad Elster is 44 to 56%. Finally it is referred to the particular tasks of pre- and postoperative physiotherapy in the advanced stages of an arthrosis before and after implantation of artificial joint replacement.

ZUCKERMAN, J.D., MIRABELLO, S.C., NEWMAN, D., GALLAGHER, M., CUOMO, F.

The painful shoulder: Part II. Intrinsic disorders and impingement syndrome. American Family Physician; 43, 1991, no. 2, p. 497-512, 50 ref.

Nivel (C 3744)

Intrinsic disorders that can cause shoulder pain include arthritis, gout, pseudogout and osteonecrosis. In its mildest form, impingement syndrome may cause only minimal discomfort. At its worst, impingement syndrome may lead to rotator cuff tear. Bicipital tendinitis and rupture of the biceps tendon may also be associated with impingement. Early rehabilitative intervention is important. Physical therapy is directed toward restoring range of motion and muscle strength.

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## Authors Index

### A

ABEL, M.S. . . . .	51
ACHTERBERG, J. . . . .	67
ALARANTA H.T. . . . .	37
ALBERS, J.W. . . . .	2
ALDERIN, M. . . . .	5, 6
ALLEN, M.E. . . . .	1, 18
ANDERSON, M.A. . . . .	47
ANDERSON, S.I. . . . .	7
ANDERSON, S.K. . . . .	14
ASH, C.J. . . . .	25

### B

BANWELL, B.F. . . . .	2, 9
BAR-OR, O. . . . .	67
BARDWICK, P.A. . . . .	1
BARNES, D. . . . .	35, 40
BASMAJIAN, J.V. . . . .	1
BATTIE, M.C. . . . .	25
BAUNSTEIN, E.M. . . . .	2
BAVIERA, B. . . . .	25
BEALS, C.A. . . . .	2
BEARD, B. . . . .	70
BECKERMAN, H. . . . .	34
BEGEL, R.R. . . . .	68
BELL, D.A. . . . .	72
BENNETT, R.M. . . . .	68
BENTLEY, G. . . . .	68
BENTZEN, L. . . . .	38, 39
BERG, U. . . . .	16
BERKEBILE, C. . . . .	32
BIEDERT, R. . . . .	58
BIGOS, S.J. . . . .	25
BIRD, H.A. . . . .	9
BIUNDO, J.J. Jr . . . . .	2
BLAIR, B. . . . .	26
BLANPIED, P.R. . . . .	47
BLOCH, D.A. . . . .	59, 60
BLOCK, J.E. . . . .	52, 69
BOACHIE-ADJEI, O. . . . .	26
BOLAND, A.L. . . . .	51
BONAFEDE, R.P. . . . .	68

BOOCOCK, M.G. . . . .	54
BOUTER, L.M. . . . .	34
BREWER, V. . . . .	69
BROOKS, G.A. . . . .	52
BROSTROM, L.A. . . . .	71
BROWN, D.G. . . . .	63
BROWN, M.D. . . . .	31
BUNNING, R.D. . . . .	3
BURNETT, T.H. . . . .	25
BURRY, H.C. . . . .	52
BYERS, P.H. . . . .	3

## C

CALDRON, P. . . . .	17
CALDWELL, J.R. . . . .	62
CALKINS, E. . . . .	8
CARDENAS, D.D. . . . .	50
CARE, G. . . . .	4, 9
CARMEN, G.M. . . . .	41
CARPENTER D.M. . . . .	29, 30
CASPERSEN, C.J. . . . .	11
CASTOR, C.W. . . . .	2, 9, 10
CHAMBERLAIN, M.A. . . . .	4
CHANTRAINE, A. . . . .	53, 55
CHASE, W. . . . .	42
CHRISTENSEN, I. . . . .	38, 39
CHU, C.P. . . . .	46
CLANCY, S. . . . .	50
CLARK, A. . . . .	17
CLARK, S.R. . . . .	68
CONLON, P. . . . .	17
CONNELL, K.J. . . . .	17
COVAL, K. . . . .	40
COWPER, P.A. . . . .	73
CROWLEY, G.M. . . . .	73
CUOMO, F. . . . .	79

## D

DALTROY, L. . . . .	45
DANNESKIOLD-SAMSOE, B. . . . .	4, 12
DAUWALTER, T. . . . .	70
DIAL, C. . . . .	5
DICKSTEIN, D.A. . . . .	44
DIETZ, F. . . . .	11
DILLIN W.H. . . . .	66



DIPASQUALE, R.C. . . . .	73
DIXON, J.S. . . . .	9
DONCHIN, M. . . . .	26
DONELSON, R. . . . .	27
DORMAN T.A. . . . .	43
DORR, L.D. . . . .	53
DOUGLA S.V. . . . .	21
DRAGONI, S. . . . .	64
DREISINGER, T.E. . . . .	15

## E

EATON, H. . . . .	45
EDSTROM, L. . . . .	16
EDWARDS, N.L. . . . .	62
EEK, B.C. . . . .	34, 43
EICHNER, E.R. . . . .	5
EKBLOM, B. . . . .	5, 6, 16, 17, 70
EKDAHL, C. . . . .	6, 7
ELNAGGAR, I.M. . . . .	27
ERICKSON, D. . . . .	70
ERNST, E. . . . .	8, 28
EVANS, B.W. . . . .	10

## F

FAIRCLOUGH, J.A. . . . .	55
FEUSSNER, J.R. . . . .	73
FISHER, N.M. . . . .	8
FIX, C.K. . . . .	30
FLOMAN, Y. . . . .	26
FORRE, O. . . . .	73
FOSTER, D. . . . .	29
FOSTER, D.N. . . . .	28
FRIDSTROM, M. . . . .	5, 6
FRIEDLANDER, A. . . . .	69
FRIEDLANDER, A.L. . . . .	52
FRIES, J.F. . . . .	59, 60
FULTON, M.N. . . . .	28, 30

## G

GALL, V. . . . .	45
GALLAGHER, M. . . . .	79
GARBUTT, G. . . . .	54
GATCHEL, R.J. . . . .	35, 40

GATES, D.M. . . . .	22
GAUVIN, M.G. . . . .	28
GECHT, M. . . . .	17
GENANT., H.K. . . . .	52, 69
GERBER, L.H. . . . .	8
GERBERICH, S.G. . . . .	70
GIRGIS, F. . . . .	50
GOLDBARG, A.N. . . . .	70
GOLDBERG, L. . . . .	68
GOLDSMITH, C. . . . .	71
GOODMAN, L. . . . .	75
GRAHAM, G.P. . . . .	55
GRAMSE, R.R. . . . .	46
GRANHED, H. . . . .	55
GRAVES J.E. . . . .	29, 30
GREMION, G. . . . .	55
GRESHAM, G.E. . . . .	8
GROH, J. . . . .	71

## H

HAGAN, R.D. . . . .	69
HALL, P. . . . .	75
HALLIDAY, P.D. . . . .	72
HALSKOV, O. . . . .	12
HANSEN, T.M. . . . .	74
HARFIELD, B. . . . .	4
HARKAPAA, K. . . . .	30, 40, 41
HARKCOM, T.M. . . . .	9
HARLOWE, D. . . . .	22
HARMS-RINGDAHL, K. . . . .	20
HARTLEY, L.H. . . . .	45
HARVEY, J. . . . .	56
HASTINGS, C. . . . .	32
HAWKES, J. . . . .	9
HEIJDEN, G.J. VAN DER . . . . .	34
HELENIUS, H.Y. . . . .	37
HELEWA, A. . . . .	71
HELLIWELL, P.S. . . . .	57
HENNING, C.E. . . . .	61
HESSELSON, G. . . . .	38, 39
HEWETT, J.E. . . . .	14, 15
HICKS, J.E. . . . .	9
HILL, C.S. . . . .	11
HINNANT, D.W. . . . .	48
HOPKINS, R. . . . .	23
HOSEA, T.M. . . . .	51
HOSHINO, D. . . . .	40
HOWALD, H. . . . .	58, 60

HUBERT, H.B. . . . .	59
HUBERT, L.J. . . . .	43
HUGHES, I.G. . . . .	39
HURRI, H. . . . .	30, 31, 40, 41
HWANG, S.M. . . . .	11

## I

IKE, R.W. . . . .	10, 22
ILSTRUP, D.M. . . . .	46
ISDALE, A. . . . .	57

## J

JACKSON, C.P. . . . .	31
JACKSON, M. . . . .	23
JARVIKOSKI, A. . . . .	30, 40, 41
JARVINEN, M. . . . .	58
JOKL, P. . . . .	10
JONES, A. . . . .	29
JONES, H. . . . .	59
JONES, H.H. . . . .	60
JOYCE, K. . . . .	32
JUCKER, A. . . . .	60

## K

KAHANOVITZ, N. . . . .	27, 32
KANNUS, P. . . . .	58
KAPLAN, L. . . . .	26
KARPER, W.B. . . . .	10
KAY, D.R. . . . .	14, 15
KEANE, G.P. . . . .	33
KEELE, M.S. . . . .	69
KELLETT, D.A. . . . .	33
KELLETT, K.M. . . . .	33
KILBOM, A.S.A. . . . .	71
KIRSTEINS, A.E. . . . .	11
KISHINO, N.D. . . . .	40
KITZMAN, D.W. . . . .	73
KLEIN, R.G. . . . .	34, 43
KNIPSCHILD, P.G. . . . .	34
KNOBLOCH, M. . . . .	58, 60
KOES, B.W. . . . .	34
KOHLES, S. . . . .	35
KOMNAES, H.B. . . . .	73

KOTKKE, T.E. . . . .	11
KRAAG, G. . . . .	71
KREINDLER, P.T. . . . .	12
KRIEGEL, M.L. . . . .	48, 49
KRISTY, J. . . . .	74
KUMAR, S. . . . .	35

**L**

LAMPMAN, R.M. . . . .	2, 9, 10
LANE, N.E. . . . .	59, 60
LARSON, J.W. . . . .	44
LAURENT, E. . . . .	76
LAWLIS, F. . . . .	67
LEE, C.K. . . . .	36
LEGGETT, S.H. . . . .	29, 30
LEHTO, T.U. . . . .	37
LEIVSETH, G. . . . .	12
LEWIS, C.B. . . . .	12
LEWIS, S. . . . .	70
LIANG, M.H. . . . .	45
LIEMOHN, W. . . . .	37
LINDELL, B. . . . .	20
LOESER, R.F. . . . .	19
LOHMAN, W. . . . .	38
LONGLEY, S. . . . .	62
LOVEJOY, B. . . . .	45
LOVGREN, O. . . . .	5, 6
LUNDBERG, E. . . . .	38, 39
LUNDQVIST, K. . . . .	16, 17
LUTNESS, M.P. . . . .	46
LYNCH, M.A. . . . .	61
LYNGBERG, K. . . . .	4, 12

**M**

MACHOVER, S. . . . .	13
MAFFULLI, N. . . . .	63
MAI, F.M. . . . .	72
MANDEL, J.H. . . . .	38
MANNICHE, C. . . . .	38, 39
MARCHOT, O. . . . .	21
MARSHALL, W.H.J.R. . . . .	60
MARTI, B. . . . .	58, 60
MARTIN, P.R. . . . .	39
MARYMONT, J.V. . . . .	61
MATERSON, R.S. . . . .	3

MATTSSON, E. . . . .	71
MAYER, T.G. . . . .	35, 40
MCCAIN, G.A. . . . .	72
MCCUBBIN, J.A. . . . .	13
MCDANIEL, L.V. . . . .	74
MCGRATH, M.J. . . . .	75
MCGRAW, P. . . . .	67
MCNEAL, R.L. . . . .	14
MCQUADE, K.J. . . . .	50
MELL, D.B. . . . .	48
MELLIN, G. . . . .	30, 40, 41
MENGSHOEL, A.M. . . . .	73
MEYER, B.M. . . . .	69
MILLION, R. . . . .	14
MINOR, M.A. . . . .	14, 15
MIRABELLO, S.C. . . . .	79
MITCHELL, R.I. . . . .	41
MONCUR, C. . . . .	15
MONGA, M. . . . .	75
MORELLI, B. . . . .	55
MOREY, M.C. . . . .	73
MORITZ, U. . . . .	7
MORRISON, G.E. . . . .	42
MULVIHILL, M. . . . .	32

**N**

NACHEMSON, A. . . . .	42
NAMEY, T.C. . . . .	16, 77
NAUMAN, J. . . . .	62
NELSON, D. . . . .	68
NEWMAN, D. . . . .	79
NICHOLS, G. . . . .	40
NICHOLS, P.J. . . . .	39
NICKEL, V.L. . . . .	74
NORDEMAR, R. . . . .	16, 17, 20
NORDHOLM, L.A. . . . .	33
NORDIN, M. . . . .	27, 32

**O**

OLAND, G. . . . .	43
OLSON, C. . . . .	70
OLSSON, E. . . . .	71
ONGLEY, M.J. . . . .	43
OVERMAN, S.S. . . . .	44

## P

PANUSH, R.S.	17, 62, 63
PARNIANPOUR, M.	27, 32
PENDERGAST, D.R.	8
PERLMAN, S.G.	17
PETTERSSON, H.	62
PIEL, B.	40
PINTORE, E.	63
POLLOCK, M.L.	29, 30
POORTMANS, J.R.	76
PORTER, J.	68
POTHIER, B.	18
POULSON, E.	70
PRUITT, C.O.	44
PURANEN, J.	64

## R

RAAB, D.M.	77
RASMUSSEN, J.O.	74
REIKERAS, O.	12
REILLY, K.	45
REILLY, T.	54
RIDDLE, D.L.	28
RISUM, T.	4
ROBB-NICHOLSON, L.C.	45
ROBERTS, W.L.	42
ROBINSON, M.S.	17
ROCKEY, P.H.	44
ROSE, M.J.	39
ROSS, S.	70
ROSSI, F.	64
ROTH, H.	45
ROTHSTEIN, J.M.	28
RUDD, E.	18, 75
RUSH, S.	12
RUSSELL P.L.	39

## S

SAAL, J.A.	33
SAPECKY, A.J.	13
SATTERSTROM, G.	5, 6
SATTERTHWAITE, J.R.	48
SCHAEFER, P.T.	12

SCHAPIRA, D. . . . .	75
SCHEIB, J.S. . . . .	64
SCHMIDT, C. . . . .	62
SCHMIDT, K.L. . . . .	19
SCHOUTENS, A. . . . .	76
SCHUCHARDT, E. . . . .	66
SCHUR, P.H. . . . .	45
SEMBLE, E.L. . . . .	19
SERFASS, R. . . . .	70
SHEIKHZADEH, A. . . . .	27
SIKORSKI, J.M. . . . .	46
SIMPSON, U. . . . .	59
SINACORE, J.M. . . . .	17
SINAKI, M. . . . .	46
SMIDT, G.L. . . . .	47
SMITH, E.L. . . . .	77
SMITH, R. . . . .	69
SMITH, R.L. . . . .	48
SNYDER-MACKLER, L. . . . .	65
SPECHT, D. . . . .	68
SPRING, H. . . . .	65
STEIGER, P. . . . .	52
STENSTROM, C.H. . . . .	20
STOKES, B. . . . .	71
STORK, J. . . . .	62
STUBBS, H.A. . . . .	52
SULLIVAN, R.J. . . . .	73
SUWALSKA, M. . . . .	21
SVENSSON, B. . . . .	7
SWANBERG, E. . . . .	20
SWEZEY, R.L. . . . .	1

## T

TANNER, S. . . . .	56
TELLING, M. . . . .	4
THOMPSON, W.G. . . . .	77
TOLLISON, C.D. . . . .	48-50
TORK, S.C. . . . .	21
TORRES-RAMOS, F.M. . . . .	2
TORSTENSSON, J. . . . .	12
TOUZET, P. . . . .	21
TROUP, J.D. . . . .	54
TSCHOPP, A. . . . .	60
TURNER, J.A. . . . .	50
TVEITEN, G. . . . .	43

## U

UPTON, S.J. . . . .	69
---------------------	----

## V

VAN DEUSEN J. . . . .	22
VERBRUGGE, L.M. . . . .	22
VERDERAME, R. . . . .	32
VINGARD, E. . . . .	78
VIOLA, K. . . . .	32
VUOSO, R. . . . .	29

## W

WASSER-SCOTT, P. . . . .	70
WATKINS, R.G. . . . .	66
WEBB, K.A. . . . .	75
WEBEL, R. . . . .	14
WEBEL, R.R. . . . .	15
WEBSTER, E. . . . .	62
WETZ, H.H. . . . .	66
WHITE, R.W. . . . .	47
WILLIAMS, H.J. . . . .	15
WILLIAMS, R. . . . .	45
WINDSOR, R.A. . . . .	5
WOLFE, L.A. . . . .	75
WOOD, P.D. . . . .	60
WOOLF, O. . . . .	26
WRIGHT, E. . . . .	45
WRIGHT, V. . . . .	9, 23
WYNN-PARRY, C.B. . . . .	50

## Y

YABUT, S. . . . .	32
YARBORO, C. . . . .	32
YOCUM, D. . . . .	32
YONKER, R. . . . .	62
YOUNG, V. . . . .	42



**Z**

ZACHRISSON, L. . . . .	16, 17
ZIELKE, A. . . . .	78
ZUCKERMAN, J.D. . . . .	79

-----



## Subject Index

### A

activity	1
adl	9, 17, 75
aerobic capacity	7, 9, 12, 15, 19, 37, 45, 67, 71, 73
aerobic exercise	2, 8, 10, 14, 18, 19, 28, 31, 45, 51
aerobic exercises	50, 75
aerobic fitness	45, 68
aerobic running	59
aerobic training	65
animals study	3
ankylosing spondylarthritis	19, 65
ankylosing spondylitis	71, 74
arthrographic measures	3
arthroplasty	53, 55
athletes	52, 53, 56, 64-66
atrophy	10, 18

### B

bicycle ergometer	2, 45
bicycling	16, 53, 70
biomechanics	37
bobsleders	58
bone density	52, 59
bone mass	69, 76, 77
bone minerals	60

### C

calisthenics	26
cartilage	19, 21, 55, 62, 63
cervical spine	15
chondromalacia	55
clinics	41, 44
computers	34
conservative treatment	34, 46
coxarthrosis	78
cva	5, 10, 77
cycle ergometer	10
cycling	20, 56, 73

## D

dance-based exercise . . . . .	18
demographics . . . . .	38, 43
dentists . . . . .	37, 44
dynamic training . . . . .	6

## E

education . . . . .	41, 71
electrical stimulation . . . . .	32
encephalins . . . . .	42
ergotherapy . . . . .	8
exercise tolerance . . . . .	2, 45
exertion . . . . .	5, 16, 20
extension exercises . . . . .	27, 31, 46
extension strength . . . . .	47

## F

fatigue . . . . .	9, 30, 45
fibrositis . . . . .	68
financial aspects . . . . .	1, 25, 33, 42
fingertip tip to floor . . . . .	71
flexibility . . . . .	32, 72, 73
flexion exercises . . . . .	46, 49
forward bending . . . . .	29

## G

group training . . . . .	16, 17
gymnastics . . . . .	19, 65

## H

hands . . . . .	9
health policy . . . . .	1
heat exercise . . . . .	18
heat treatment . . . . .	8, 19
heavyweight lifters . . . . .	55
hematology . . . . .	5
hip . . . . .	12, 37, 41, 60, 64, 75
hospital employees . . . . .	26
hospitals . . . . .	4, 9, 42, 48
hydrotherapy . . . . .	8
hypoactivity . . . . .	67

## I

impingement syndrom . . . . .	79
inactivity . . . . .	5, 19, 44, 68, 76, 77
internists . . . . .	44
interval training . . . . .	10
isometric exercise . . . . .	13
isometric training . . . . .	29

## J

jogging . . . . .	37, 56
joint replacement . . . . .	53
juvenile arthritis . . . . .	21, 67

## K

kinesiology . . . . .	18
knees . . . . .	4, 8, 12, 37, 51, 53, 58-60, 68, 70
knee replacement . . . . .	71

## L

laser biostimulation . . . . .	34
lifestyle . . . . .	14, 56
lifting . . . . .	56
lifting capacity . . . . .	40
lower extremities . . . . .	6, 7
lumbar extension . . . . .	29, 30
lumbar flexion . . . . .	30
lumbar spine . . . . .	56
lumbar spondylolysis . . . . .	64
lupus erythematosus . . . . .	32

## M

marathon runners . . . . .	54, 69
massage . . . . .	38, 78
McKenzie approach . . . . .	27, 56
mobility . . . . .	3, 41, 42, 64, 74
muscle fibresize . . . . .	16
muscle function . . . . .	6, 8
muscle strength . . . . .	1, 5, 7, 8, 10, 13, 16, 19, 32, 39, 41, 47, 67, 73, 75, 79

## N

neck pain . . . . .	27, 37, 44
nerve stimulation . . . . .	50
nurses . . . . .	38
nursing home . . . . .	2

## O

osteocondritis . . . . .	63
osteonecrosis . . . . .	79
osteoporosis . . . . .	69, 75, 77
overweight . . . . .	22, 78

## P

pelvis . . . . .	28
placebos . . . . .	34
polo players . . . . .	52
postural exercise . . . . .	36
posture . . . . .	37
pregnancy . . . . .	75
prevention . . . . .	25
primary fibromyalgia . . . . .	72, 73
programs . . . . .	1-3, 13, 16, 25, 26, 33, 39, 43, 45, 46, 49, 71, 74
prone spinal extension . . . . .	48
prone trunk extension . . . . .	47
psychologists . . . . .	20

## Q

quadriceps . . . . .	2, 4, 12, 13, 68, 70
quality . . . . .	34
questionnaires . . . . .	5, 6, 17, 20, 35, 46

## R

range of motion . . . . .	5, 13, 14, 21, 22, 30, 47, 48
recreational exercises . . . . .	62, 63
relaxation techniques . . . . .	67
resistance exercise . . . . .	13, 29
resistance training . . . . .	30
rest . . . . .	5, 18, 22, 25, 28, 44

rowing	51
runners	58-60, 62
running	1, 52, 54, 60, 64, 70

## S

sclerosis	59, 60
self-confidence	20
short term training	6
shoulder	64, 79
sick leave	31, 33
sit-ups	25, 47
smoking	78
soccer players	53
social support	18
spinal flexion	27
spinal mobility	31, 39, 41, 46
spinal shrinkage	54
spine	37, 59
spondylolisthesis	46, 56
spondylolysis	38, 39, 56
statistics	29, 39
stiffness	3, 14, 74
strength	42
strength measurement	31
strengthening exercises	36, 46, 49, 56, 68, 70
stretching	12, 49, 56, 64, 65, 73
sweden	25
swimming	53, 70

## T

table tennis	63
Tai-Chi Chuan	11, 22
technology	35
thermal therapy	1, 2
thermotherapy	38, 39, 78
tissue	9, 15, 41-43, 66
treadmill	15
trunk flexion	26, 47
trunk muscle	36
trunk strength	35, 40

**U**

ultrasound . . . . . 9

**V**

vocational counseling . . . . . 36

**W**

walking . . . . . 14, 53, 71  
water exercise . . . . . 1, 4, 14, 21  
wax . . . . . 9, 23  
weight . . . . . 35, 51  
weight bearing exercise . . . . . 11  
weight lifting . . . . . 64  
weight training . . . . . 73  
weight bearing activities . . . . . 52  
women . . . . . 9, 32  
wrestlers . . . . . 55  
wrist . . . . . 75



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