UNBREAKABLE

STRENGTHENING Ones JOINTS According To SCIENCE

Over 100 Illustrated Exercises

JEAN-LUC ANDRE (Pt.)

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FOREWORD

The information contained in this book is based on science (the numbers in brackets refer to the studies cited at the end of the book). It is easily verifiable, either by consulting the bibliography or by doing a bit of online research. A small part relates the results of coaches and athletes or is based on my own experience.
Who is this book for? Anyone who wants to better understand their body and develop strong joints by freeing themselves from chronic injuries or reducing their risk of future injury. Physiotherapists, coaches, and athletes who want a practical manual on prevention.
With modern lifestyles having made joints one of the weakest links in the human body, knowing how to strengthen ligaments, tendons, and cartilage, as well as preserving the body's elasticity, is a major asset in performance as well as in the fight against aging.

A glossary at the end of the book clarifies the technical terms.

INTRODUCTION

I am passionate about sports, but in my thirties my joints gave out on me one after the other. The first in the series of injuries was the fracture of my scaphoid in a roller-skating fall. Not long after that, I began to experience hip pain; a year later, it was a supraspinatus tendon tear while lifting dumbbells. Finally, I ended up the series first with knee sprain while skiing and a tennis elbow. Were these injuries due to sporting excesses? It may well have, but high-dose sport isn't necessarily destructive. For example, surfer Kelly Slater continues to collect titles at the age of 51, as does former Patriots quarterback Tom Brady, who remained at the top of his game until his retirement at the age of 45 in a high-risk sport for injuries. Zlatan Ibrahimovic, despite cruciate ligament problems, stunned his surgeons with the robustness of his knees after 23 years as a striker. Even if genetics play an obvious role in sporting longevity, these athletes clearly do something better than others. Avoiding injury is a skill that anyone can acquire, but one has to know how.

In my search for a solution to slow down, or even reverse, the ageing of my joints, the advice of an eminent Parisian rheumatologist wasn't much help, as he encouraged me to limit myself to swimming, cycling and Pilates, when in fact self-restraint is the worst option: "Use it or lose it', as they say in the States. Indeed, the impacts of running may not be as harmful as previously thought - studies show that joggers have larger intervertebral discs than the rest of the population" (2). Why should you give up your passion for a sport you don't really enjoy? It would be wiser to adapt the intensity and duration of your training to stay below the pain threshold, while strengthening your joints at the same time!

Unscrupulous individuals dangle miraculous herbal solutions in front of patients. These certainly have many benefits but having tried many of them: from turmeric to devil's claw to rare Amazonian plants, none of them had any convincing effect on my joint pain, including supplements that have been validated by studies, such as glucosamine and chondroitin. For some people, giving up dairy altogether has enabled them to get rid of chronic tendonitis, but there's no proof that this will work for you, especially if you're not lactose intolerant. To my knowledge, there is only one effective supplement for joints, and the good news is that it's easy to obtain. It's an adjuvant, not a substitute for rehabilitation, and you won't feel the effects until you've been on it for at least three months (see the section on diet). An anti-inflammatory diet, as well as the use of supplements with analgesic or anti-inflammatory properties (turmeric, MSM, etc.), and the intake of vitamin D—studies have established a link between its deficiency and musculoskeletal disorders (McBeth et al., 2010)—are other rational precautions to relieve pain.

The real solution to keeping your joints in perfect condition is to diversify your motor patterns,i.e. your range of movement, just as a singer expands his vocal range by practicing scales.

You should also tone up your fascia every day to take the strain off your joints. Just as you train (I hope) your muscles and your heart, devote ten minutes a day to strengthening your joints, and they will support you for the rest of your life. The closer the muscles are to the joint, the more important they are for its health. Consequently, the rotators must be systematically trained for joint health (except for the spine, which works differently). But we only train them when we're injured, which is a mistake.

I often ask myself the question: why are we so stiff in the way we move, compared to animals? "For example, an animal can remain motionless for hours on the lookout and then sprint without muscle strain. We're under constant stress, and unlike animals, whose cortisol levels soar in situations of fight or flight, but quickly return to normal once the danger has passed, the shocks of life tend to leave an indelible imprint on the human body.

But the tensions that accumulate throughout life, to the point of saturating the muscles, do not explain the stiffness and lack of coordination displayed by the vast majority of teenagers during sporting activities. Is this the fault of our lifestyle, which is too lacking in movement, both qualitatively and above all quantitatively? I'm personally convinced of this. A hyper-secure environment that encourages immobility is the antithesis of that in which a wild animal evolves, where obstacles and variety stimulate the development of its full potential.

So, it's not surprising that we all suffer, to varying degrees, from joint pathologies, because we move too little and according to patterns stereotyped by our profession or the sports we play.

By devoting just seven minutes a day to stimulating the development of our ligaments, bones, and tendons, we can make ourselves much less prone to injury. Not all of them are avoidable, of course, but many can be, provided we are proactive.

By the way, the goal is not to never get injured, otherwise there is a risk of developing hypervigilance and fear avoidance in situations incorrectly perceived as potentially dangerous, such as fun and playful activities or those involving an element of chaos. It is rather to become resilient meaning resistant to inury in the sens to be minimally affected by them and to recover stronger and quickly as possible (jumping forward instead of jumping back).

Furthermore, one must avoid having too narrow a conception of the range of movements that are 'correct' and 'risk-free', as this may dissuade us from engaging in certain activities where total control is impossible, such as team sports, contact sports, competition, thereby contributing to an internal perception of ourselves as fragile.

PART ONE: PRINCIPLES OF PREHABILITATION

Avoiding the Pitfalls of a Sedentary Lifestyle at Work

Your joints need constant (but not necessarily intense) activity. Optimize your workspace, as this is where you spend most of your waking hours! Ideally, you should be able to alternate between standing and sitting at two desks, install a small pedal under your desk to keep your legs moving constantly, and get up every 45 minutes, using sound reminders, to spend a few moments walking, hanging from a bar, or doing twenty squats. This basic form of exercise is said to be effective in preventing pathologies linked to prolonged immobility. One hour of intensive sport is not as beneficial as 12 times of five minutes of exercise, spread throughout the day.

Elasticity and Strength, the Yin and Yang of a Functional Body

According to a Russian saying, you're old when you can't jump any more, because to do so you need an elastic body, a rare quality after the age of 30. If the strength exceeds the elasticity of the body, injuries will occur. Hackenschmidt, a wrestler in the first half of the 20th century, could jump over a rope stretched between two chairs at the age of 75 (photo). Elasticity peaks in children and then decreases if it is not maintained. Unfortunately, few physical trainers are aware of its importance.

Tissue elasticity depends on a number of factors. These include nutrition, hydration, sleep quality, cellular permeability, mitochondrial function, vascularization, oxygen saturation, mobility, VO2 max, motor patterns and, of course, the optimal organization of collagen fibers (poorly repaired old injuries often cause fibrosis, which is a source of stiffness). This quality is maintained through myofascial massage (foam roller, Lax Ball etc.), training on unstable surfaces, the use of 'soft' weights (sandbags etc.), elastic bands, isometric and eccentric work. There are enough videos on YouTube of massages with foam roller that I won't dwell on them any further. Their function is to keep muscles long and supple and this is particularly important if you're doing bodybuilding, as it tends to produce the opposite effect. Let's not confuse stretching, mobility and pliability. Stretching is passive: if after a 20-minute warm-up I can do a split, I'm flexible, but being able to lift my leg 90° in a standing position shows good mobility, because in this case the range of movement is controlled by my muscles and not by gravity. Doing it without warming up shows pliability, i.e., long muscles even at rest, after all there are situations in life when you don't have the leisure to warm up, when someone attacks you in the street for example or you have to sprint to get to an important appointment on time.

The Iron Law that Charlatans Hide From You

The brain produces pain (not the site of injury). Pain is modulated by the situation, similar past experiences, emotional state, location, and beliefs. If you sprain your ankle when you're traveling and under stress, it will seem more painful than if you sprain it at home surrounded by your family. Therapists have a duty to speak to their patients in a non-anxiety-inducing way, to avoid the 'nocebo' effect (the opposite of placebo). Telling a patient: "Your back's in tatters!", by pointing to the abnormalities in their X-ray, is tantamount to aggravating their symptoms, or even creating them from nothing. Maintaining regular physical activity and trying to ignore tolerable pain as much as possible helps to raise the patient's pain tolerance threshold. The brain is like an overprotective mother who will be reassured if you show her that you can play without hurting yourself. Any painful signal, repeated over time, strengthens the nociceptive synaptic connections and tends to become chronic, to persist even when the initial cause has disappeared. What's more, tendon rehabilitation is slowed down by cortical inhibition, which inhibits muscle contraction when it is perceived, rightly or wrongly, as dangerous. Hence the importance of using a metronome during eccentric or HSR (Heavy Slow Resistance) exercises to get around this cerebral brake by pre-activating the muscle (your muscle activates before the cerebral command). Neuroplasticity (macro aspect) should not, however, overshadow bioplasticity (micro). Unlike the nervous system, which adapts quickly, biological tissues need to be stimulated for a long time to change. If you are 50 years old and have been stooped all your life, no amount of manual therapy, motor reprogramming or postural T-shirts will improve your posture in the long term. You will have to go through a long phase of corrective exercises, aimed at correcting the structural changes your body has undergone. The sign of a quack? They always offer a quick, effortless 'solution' to a chronic problem. What took years to establish will also take time to disappear. The best approach is to work on both bioplasticity and biopsychosocial conditions (basically your emotional well-being), to raise the pain threshold.

Correlation between Bone Density and Strength

With thin bones, you have little chance of shining in certain sports. A weightlifting coach told me that the reason why some beginners explode in performance in just a few months is because of their bone structure; big bones are an asset for heavy lifting, and the reverse is true: training heavy increases bone density, but someone born with thin bones will never become solidly 'built', even if they do increase their bone density a little through exercise. According to science, scrum-halves and American football quarterbacks have massive vertebrae and dense bones, as do boxers and Mixed Martial Artists (MMA) (6) who have to withstand the violence of contact.

Sports Based on Rapid Circles

Arm circles are found in many sports such as boxing, swimming, athletics, and tennis. Leg circles are also found in sports such as Taekwondo. With speed, these large circles can throw the joint off-center and cause friction between the tendons and bones if the rotator cuff is not balanced. If you practice these sports without striving for performance and if you have good mobility, the risks will be negligible, unlike, for example, a butterfly swimmer. Studies have shown that neck circumductions, long used in sports warm-ups, promote cervical osteoarthritis.

Non-Functional Exercises

The tendency is to say that there are no bad exercises, only poorly executed ones, but let's look at some concrete examples. Statistically, the bench press is the most injury-causing bodybuilding exercise in the gym, just ahead of the deadlift. Firstly, pushing a heavy load, lying on your back, is of no functional use in real life and the bench prevents abduction of the shoulder blades during the descent of the bar, thus encouraging rubbing of the supraspinatus against the acromion and decentering of the humeral head. In addition, the mechanical disadvantage is greatest when the shoulders are in a vulnerable position, i.e. when the bar touches the chest (horizontal extension and internal rotation), making this a very risky exercise for the shoulder. If you do a lot of functional exercises, you can allow yourself a small dose of non-functional exercises, but as a general rule it's best to avoid them. Weighted waistcoat push-ups are a good alternative to bench presses.

Ignoring the Stages of Progress

Avoid bodybuilding programs where loads are constantly increased without any adaptation/plateau period. According to the principle of Specific Adaptation to Imposed Demand (SAID), when the objective is reached, in terms of repetitions and sets, it is advisable to increase the load by 2.5 to 5%. However, by progressing in this way over a long period of time, there comes a time when the tendons will eventually give out, because they strengthen more slowly than the muscles. You'll eventually have to take a break because your joints won't be able to keep up. You should never try to force your muscles to adapt. If you don't allow for intervals in your training program to give your tendons time to catch up, injury is almost guaranteed. Christopher Sommer, Ido Portal's mentor, trains his athletes with the same weight for 8 to 12 weeks and only increases the load when the movement becomes too easy. Following this principle reduces the risk of injury, as two months gives the tendons and soft tissues time to catch up. Tendons and ligaments also need you to vary the number of repetitions and the speed at which you do them, because some types of tendons strengthen at high volume, while for others it's the opposite.

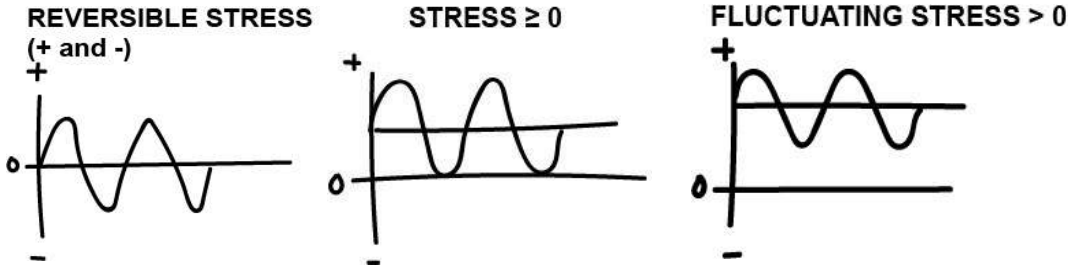
The ideal is to alternate heavy, slow training with fast, high-volume training (sets of 20 to 30 repetitions).

In Pursuit of the One More 'Rep'

Blinded by the motto of "no pain, no gain", we fall into the trap of overtraining. It's fun to assess your limits by going to muscular failure, until you can't move the load a millimeter, but the key to progress is to be regular in your sessions and avoid overtraining. Attempting to push your limits with each set is only productive for those who benefit from accelerated recovery: young people with excellent genetics or doped-up athletes. The idea of always going to the extreme limit of one's capacities is counterproductive, and Pavel Tsatsouline has shown the error of this (30) by demonstrating that it fatigues the central nervous system, compromises recovery, and shortens sporting longevity. The extra repetitions, hard earned, will paradoxically make you perform worse in the next session. It's better to finish your set with one spare repetition, and only add weight when your body demands it, because the body strengthens, even if the load remains the same for several weeks. Of course, at some point, the exercise will become too easy (your body will tell you) and you'll need to add weight, but systematically going for failure by increasing the load at each session is the wrong strategy.

The "Cyclic Sports" Trap

Cyclic activities, which contrary to what their name suggests are not limited to cycling (although cycling is one of them), are so named because they are based on a simple movement, performed tens of thousands of times. This is the case for swimming, kettlebell swinging, horse riding and also professional activities such as using a jackhammer. Other sports, which taken as a whole are non-cyclical, nevertheless include cyclical phases. Motorbike trail riding, for example, where the knees absorb the shocks of the track, producing cyclical oscillations. There are three types of cyclic stress (which can be represented by sinusoids): alternating compression and decompression causing reversible stress (e.g. cycling with strapped pedals); alternating compression and rest, such as when running (when the foot lifts off the ground the compression is canceled); and maximum and minimum compression, which is nevertheless always positive, i.e. fluctuating stress (e.g. water-skiing).



PART TWO: PRACTICE

THE TENDONS

TENDONITIS PREVENTION STRATEGIES

Light, Fast, Long with Bands

In adults, tendons are poorly vascularized and feed almost exclusively on synovial fluid. To increase the circulation of this fluid, we need to move more to 'pump' more fluid into the joint. Regular exercise also vascularizes the tendon. This involves moving the tendon over a long period of time by performing thousands of repetitions of a low-intensity exercise. The traditional or elliptical bike, the rowing machine and the "arm cycle" machine are ideal for this. Long sets of fast movements with elastic bands (100 to 300 repetitions) are one of the tendons- strengthening protocols of the legendary Westside Barbell powerlifting club (14). As the destruction of muscle fibers occurs mainly during the eccentric phase, we try to shorten this phase, using elastic bands to neutralize the production of lactic acid, which makes it possible to perform very long sets without muscle congestion and to nourish the soft tissues by increasing the blood and synovial supply. If your elbow hurts, for example, hang a rubber band over your head and do a hundred quick triceps extensions. The key point is to relax the arm during the eccentric phase and let the elastic do its work, so as to avoid straining the muscle fibers.

Vary The Speed, the Weight, and the Number of Repetitions

Certain types of tendons are stimulated by slow speeds and heavy loads, while for others it's the opposite. Vary the volume of work (number of repetitions and sets), to cover the whole spectrum and ensure maximum safety.

Functional Range Conditioning

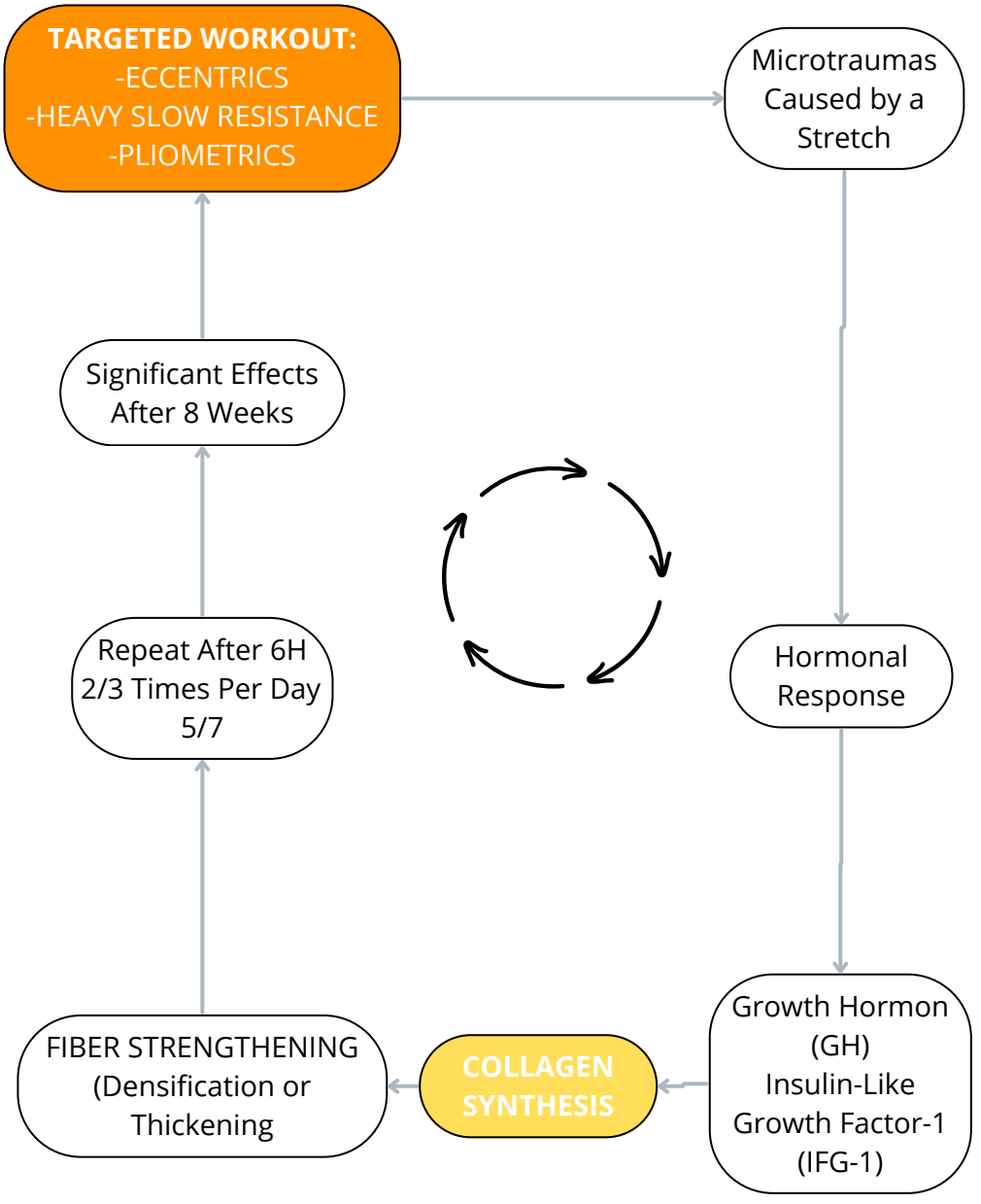
Functional Range Conditioning is a joint strengthening protocol devised by American kinesiologist Andreo Spina. Joints are vulnerable at the end or beginning of their range of motion, so why not strengthen the muscles during maximum lengthening or shortening so that they have the strength to protect the joint during these high-risk ranges? Three techniques are used: CARS (controlled joint rotations, a kind of maintenance mobilization), PAILS: progressive isometric angular loading (the equivalent of the famous contract release) and RAILS: regressive isometric angular loading. In concrete terms, this involves a passive stretch lasting 30 seconds, followed by an isometric contraction in the opposite direction to the stretch (20 seconds) and an active stretch by contraction of the antagonist (20 seconds), the last two phases being repeated three times. His method takes advantage of the stretch reflex. It is widely used by physiotherapists and top-level coaches.

6) Stretch capsule with elastic band
Sitting on the floor with one leg bent 90° in front of you, press your heel into the floor as if doing a leg curl, while pulling the upper end of the tibia towards you with a thick elastic band (or, failing that, a strap). Repeat this maneuver about ten times for four sets, to stretch the capsule.

7) Assisted tibial rotation
Bring the forefoot into abduction by pulling the knee towards you with your hand, then into adduction by pushing the knee outwards. Repeat about twenty times on each side. If the tibial rotation is incorrect, the ligaments and menisci will suffer, hence this exercise.
Make sure you rotate the tibia and not the ankle. In the photo, I've got my hand on the tibia to check that it's really moving.

8) Capsular stretch with stick
Here's the aspirin for a sore knee. Place a stick (not too thick) in the crease of your knee and squat down, balancing on the balls of your feet and leaning either on the floor or on a piece of furniture in front of you. Stay in this position for one minute, increasing every two days by 30 seconds, to eventually reach 10 minutes. Remain stoic and take breaks at the beginning, as this exercise 'stings' a little. For a softer variation, use a rolled towel.

CYCLE OF DENSIFICATION FOR SOFT TISSUES (TENDON/LIGAMENT)



You all know you need to exercise to keep your heart and muscles healthy, but would you like to know the secret to strengthening your bones and cartilage naturally and developing joints made of concrete, capable of supporting you for the rest of your life? Which exercises to select? Which training program should you prioritize? What type of muscular contraction to choose?

The aim is to achieve a young, strong, elastic and pain-free body that will enable you to remain active at any age.
After the age of thirty, our joints become the weak link, the limiting factor in our physical activity. Joint aging, medically termed "degeneration", strikes harder and earlier. There are, however, real solutions to delay it, but taking it easy in the belief that you'll wear yourself out less is not one of them.

- Advice for sedentary people and athletes (bodybuilding overhead sports, cyclic sports, martial arts, etc.)
- Can tendon, ligament and cartilage be strengthened? And if so, how?
- Nutritional aspects of joint health
- Recommended sports to optimize joint function
- Ancient strongmen's secrets for developing the "old man's strength" that withstands the test of time

And above all, more than 100 super-efficient exercises for healthy tendons, ligaments, bones and fascia.

Whatever your age or physical condition, become antifragile at last!

Jean-Luc ANDRE is a physiotherapist, coach and functional movement specialist.
He is the author of four best-selling books published by Hachette.